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(COMMITTEE ON RECONSTRUCTION)

2 vols. in 1.

THE COMPONENTS OF THE CANADIAN CONSTRUCTION INDUSTRY

Preliminary Report II — III

on

The Construction Industry in Relation to Post-War Economic Policy

by

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448974
1-7-46

Ottawa

December, 1942.

Corrected May, 1943

P.R.13,530. + P.R 14005.

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I. SYNOPSIS

This study is concerned with the following questions:

(1) Where does money spent for construction go?

(2) What are the implications of a distinction of the main components of construction for a post-war construction program?

(3) What is the trend of construction work performed by private contractors and the public authorities?

(4) What is the significance of additional construction following an initial construction project?

(5) What lessons can we draw from construction in the past to ensure an appropriate distribution of construction projects among the provinces?

(6) What factors have to be taken into consideration when making forecasts of the possible size of a post-war construction program?

The answers to these questions can be summed up as follows:

(1) Expenditures for construction purposes go with varying proportions to construction industry proper and to the material supplying and transporting industries. The Construction Census reports gross value of approximately 186.1 million dollars in 1934, steadily climbing until a gross value of 474.1 million dollars is reached in 1940. 38.02 percent of the gross value of construction went to the auxiliary industries in 1934. The proportion increased to 56.36 percent in 1940. The share of construction industry proper decreased from 61.98 percent in 1934 to 43.64 percent in 1940. This trend allows us to infer that we are heading towards greater efficiency in construction. We have by no means as yet reached a stage of efficiency comparable with that in other industries. These figures translated into the field of employment show that we are heading towards a greater use of semi-skilled and unskilled labour in the auxiliary industries and a decrease in the number of construction craftsmen employed on the site.

The need for a study appraising the construction material requirements for the main types of building and engineering construction is emphasized for the purpose of obtaining information on the requirements for construction materials by a given construction program in the post-war period. A sample study is discussed showing the material requirements for over 23,000 housing units built with assistance under the Dominion Housing Act, 1935 and the National Housing Act, 1938. The share of the lumber industry in the total expenditure for construction materials, including transportation costs, amounts to 43.7 percent. Plumbing with 11.03 percent, heating with 8.52 percent, laths and plaster with 7.32 percent, and cement, gravel and sand industry with 7.27 percent follow. The balance is made up by a number of smaller industries. It is important to realize that over-all ratios of building material requirements cannot be secured for construction projects because of the great variation of the ratios among the different types of construction projects.

(2) (A) A distinction between building, engineering and trade construction is of importance for the following reasons:

(a) Different types of construction projects make different requirements upon the construction material supplying and transporting industries.

(b) The requirements for skilled, semi-skilled and unskilled labour differ for the various types of construction projects. This is an important consideration if it is taken into account that the supply of skilled construction craftsmen is limited.

(c) An analysis of the construction program in the pre-war period gives some indication of what would be the appropriate share of building, engineering and trade construction in any construction reserve planned for the post-war period.

(d) Building construction experienced much greater fluctuations than engineering and trade construction. It is for this reason that increased government regulation and government assistance will be needed in order to smooth out the great fluctuations particularly noticeable in building construction.

(B) A distinction between new construction and alterations and repair construction is of importance for the following reasons:

(a) The proportion of labour to material varies between new and alterations and repair construction.

(b) More skilled labour is required for alterations and repair construction because the use of modern machinery is greatly limited.

(c) The value of construction work performed by one construction worker per year is greater for new construction than for alterations and repair construction.

(d) A study of the new construction cycle and the alterations and repair construction cycle shows that the fluctuations of the former are considerably greater than those of the latter. It follows that new construction deserves greater attention by the public authorities than alterations and repair construction.

(3) Since 1934 construction work performed by private contractors has increased gradually, while construction work performed by the public authorities has decreased at the same time. The share of the former amounted to 53.33 percent of total construction performed in 1934. This percentage rose to 80.08 percent in 1940. The share of the latter in total construction decreased from 46.67 percent in 1934 to 19.92 percent in 1940. The following two points show the different impact of construction expenditure by private contractors and by the public authorities:

(a) The public authorities are more concerned with alterations and repair construction. Their share in alterations and repair construction amounts to 31 percent while only 16 percent of the total new construction is carried out by the public authorities directly.

(b) The value of construction work performed by one person employed by private contractors amounted to approximately $3,654 in 1940 while a person employed on construction work performed directly by the public authorities produced a construction value of approximately $2,057.

This information might be useful for the purpose of determining the share of construction work to be performed by private contractors and by the public authorities in a post-war construction program.

(4) Secondary effects of construction expenditure include additional employment created by the necessity of maintaining or adding additional structures to construction projects already completed, and employment provided in consumer goods industries. The latter employment is generally described as "secondary employment". The former may be described as "complementary employment" because it refers to employment in additional construction which is complementary to a construction project already carried out. For example, when a new road is built, service and repair stations will be erected along the road, road caterers will erect stands to serve the tourists, and new communities may come into existence along it.

A quantitative analysis of a conduits construction job shows the importance of complementary construction. It will be shown that an initial construction expenditure of approximately $140,000 was followed by an additional expenditure for complementary construction amounting to approximately $250,000. It took about one year to complete the initial construction project, while it took about three years to complete the additional construction work required.

(5) The following two factors should be considered because of their importance for an equitable distribution of construction projects amongst the provinces in the post-war period:

(A) For the period 1934-1940 the following average gross value of construction was established for the provinces:

(a) Ontario	42.9 percent
(b) Quebec	27.49 "
(c) British Columbia, including the Yukon	7.42 "
(d) Nova Scotia	5.82 "
(e) Manitoba	4.31 "
(f) Alberta, including the North-west Territories	4.28 "
(g) New Brunswick	4.08 "
(h) Saskatchewan	3.27 "
(i) Prince Edward Island	.43 "
Canada	100.00 percent

It is emphasized that consideration has also to be given to the trend of construction as established during the period analyzed. Construction in less developed provinces undergoes greater fluctuations than construction in other more highly developed provinces. It appears to be desirable to take this factor into account when considering the assistance which the Dominion Government might give to the provinces in order to enable them to carry out construction projects in the post-war period.

(B) For the years 1938 and 1941 the following data on construction per capita for the provinces can be established:

	1941 Dollars	1938 Dollars
(a) British Columbia and Yukon	70.6	36.2
(b) Ontario	69.6	41.4
(c) Nova Scotia	57.9	32.5
(d) Quebec	54.8	31.6
(e) Alberta and Northwest Territories	44.2	16.8

	1941 Dollars		1938 Dollars
(f) New Brunswick	40.9	....	34.1
(g) Manitoba	40.9	....	19.9
(h) Saskatchewan	23.3	....	12.3
(i) Prince Edward Island	20.6	....	14.4
Canada	56.0	....	31.8

(6) Recently a statement was made by members of the National Construction Council in Toronto that, because of a limited supply of skilled labour, an annual construction program of only about $300,000,000 may be possible for the first few post-war years. This belief is not warranted for a number of reasons which are summed up in the following: (1)

(a) An annual construction expenditure of $300,000,000 in the post-war period would be below the level of the last few pre-war years. The Construction Census reported a gross value of construction varying between 351.8 million dollars in 1937 and 373.2 million dollars in 1939.

(b) The volume of construction in 1939 was far below that of 1929. It is not desirable to return to a pre-war level of construction which by no means made full use of the resources available in this country.

(c) A conference of the construction industry in 1933 made clear to the Prime Minister, the Right Honourable R. B. Bennett, that it regarded 1929 as a normal and prosperous year. The conference claimed that approximately 300,000 construction workers were employed on the site in 1929. The Dominion Bureau of Statistics estimated that the gross value of construction amounted to $590,900,000 in 1929. If it was possible to employ 300,000 men and produce a gross value of construction of approximately 600 million dollars in 1929, there is no reason to return to a construction program amounting to 300 million dollars. It appears that the recent statement made by a representative of the National Construction Council is in contradiction to the spirit of the brief presented by all national organizations interested in the construction industry to Prime Minister Bennett in 1933.

(d) The gross value of construction amounted to 474.1 million dollars in 1940, providing employment to 149,830 persons. The value of construction work performed by one person gainfully occupied in the construction industry amounted to $3,165. If we assume that 300,000 men represent a normal state of employment in the construction industry - as the construction industry claimed in 1933 - then we may conclude that this group of men could at least produce a construction gross value of 949.5 million dollars or approximately one billion dollars in the post-war period.

(e) The above estimate is rather conservative. Value of construction work performed by one person amounted to $1,075.1 in 1934. The value of work performed in any one year rose continuously reaching $3,165 in 1940. It is clear that technological improvements are liable to increase further the value of work which one construction worker can perform in one year. Thus 300,000 men employed in the construction industry proper will most probably be able to produce a gross value of construction considerably higher than one billion dollars in the post-war period provided the labour resources available are used economically.

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(1) An elaboration of the implication of the analysis given above is dealt with in Report VI.

(f) Greater efficiency per person employed on the site is also supported by the fact that the proportion of the expenditures for construction materials increased considerably during the period 1934-1940. Of the total expenditure for construction 38.02 percent went into cost of material in 1934, while 56.36 percent went into material in 1940. In addition to increased use of construction material greater efficiency on the site will contribute to increased value of construction work per man-year. This can be achieved by a greater use of machinery on the site and a more efficient use of construction labour.

(g) The Dominion Bureau of Statistics reports a construction gross value of 639 million dollars in 1941. This is already 8 percent over the level of construction in 1929. It was possible to carry out such a construction program in spite of the fact that, as of August 1942, approximately 35,000 skilled construction workers were serving in the armed forces. These men form a reserve of skilled construction workers which will be available after the war. In addition there are a number of construction workers among the 900,000 persons estimated to be doing war work at the present. Practically the whole group will be released for civilian production once the war is over. These two groups of construction workers form a reserve of skilled men who will have to be absorbed in an expanded construction program.

(h) It will be shown that modern machinery makes possible an increased use of semi-skilled and unskilled workers in the construction industry and thus reduces the requirements for skilled construction workers.

If the factors mentioned above are taken into consideration, it can be concluded that a construction program of one billion dollars is within our reach without exhausting our resources of skilled labour. This does not mean, however, that there is no need for the training of additional construction craftsmen. On the contrary, this is one of the most important tasks of the construction industry. If ways and means are found to finance a big construction program, the demand for construction might well be greater than one billion dollars. Thus, additional demands for construction craftsmen will have to be met.

It must be clear to everybody that it will only be possible to employ more men in the construction industry after the war if an annual construction program of a size greater than in the last war year is carried out. Assuming that the volume of construction will amount to approximately $600,000,000 in the last war year, it becomes clear that we will require at least an additional expenditure of $400,000,000 in order to provide employment for these construction craftsmen, semi-skilled and unskilled construction workers released from the armed forces and the war factories who will be looking for work. It is obvious that a construction program of one billion dollars will not only give considerable employment to men working in the construction industry itself but also to a great number of persons employed in the construction material supplying and transporting industries.

An elaboration of the topics discussed in (1) to (5) is given in the following sections.

II. THE RELATIVE IMPORTANCE OF CONSTRUCTION INDUSTRY PROPER AND THE CONSTRUCTION MATERIAL SUPPLYING AND TRANSPORTING INDUSTRIES

The question is often asked "Where does the money spent for construction purposes go?" It is endeavoured in this section to give a concise answer. Following the analysis already made, the answer will distinguish between construction industry proper and the construction material supplying and transporting industries, sometimes described as auxiliary industries (see Report I). The aggregate of these industries makes up construction industry in its extensive sense.

Construction Industry Proper

Although the Construction Census does not cover the whole of construction activity in Canada, it gives a fair picture of a major part of the volume of construction. Using the terminology of the Dominion Bureau of Statistics, a distinction has to be made between the net value and gross value of construction. The latter term refers to the total value of construction as reported by the Construction Census, including expenditures for construction material and transportation costs, while the former term refers to the residue of the expenditures after the construction materials and transportation costs have been deducted.

The Construction Census provides information on wages, salaries and distributed profits and overhead expenses and undistributed profits, the total of which makes up the net value of construction. "Salaries" in the Construction Census includes distributed profits. There is no separate column for "overhead expenses and undistributed profits" but figures can be obtained by deducting wages, salaries and distributed profits and cost of material from the total gross value of construction.

The share of construction industry proper expressed by the net value of construction varied considerably during the period 1934-40. In 1934, 38.02 per cent went to the material supplying and transporting industries and 61.98 per cent went to construction industry proper. (See Tables I and II and Figure I)[1] From 1934 onwards until 1940 a considerable increase in the share of the construction material supplying and transporting industries at the expense of the share of construction industry proper can be noted. 56.36 per cent of the total gross value of construction went to the auxiliary industries in 1940 and only the balance of 43.64 per cent went to construction industry proper. During this seven-year period the share of construction industry proper decreased from 61.98 per cent to 43.64 per cent. On the other hand, the share of the construction supplying and transporting industries increased from 38.02 per cent in 1934 to 56.36 per cent in 1940.

This trend shows an important development. It indicates declining expenditures for construction done on the site and increasing expenditures for construction materials. This trend allows us to infer that we are heading towards greater efficiency in construction. Factory produced material allows a greater use of mass production methods than is possible for construction work carried on at the site. This observation translated into the field of construction employment allows us to conclude that the construction industry is heading towards a greater use of unskilled labour than was hitherto the case. We know that unskilled and semi-skilled men are working in the construction material supplying and transporting industries. By increasing the expenditure for materials produced by the auxiliary industries, employment in these industries is

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(1) For tables see Appendix.

FIGURE I

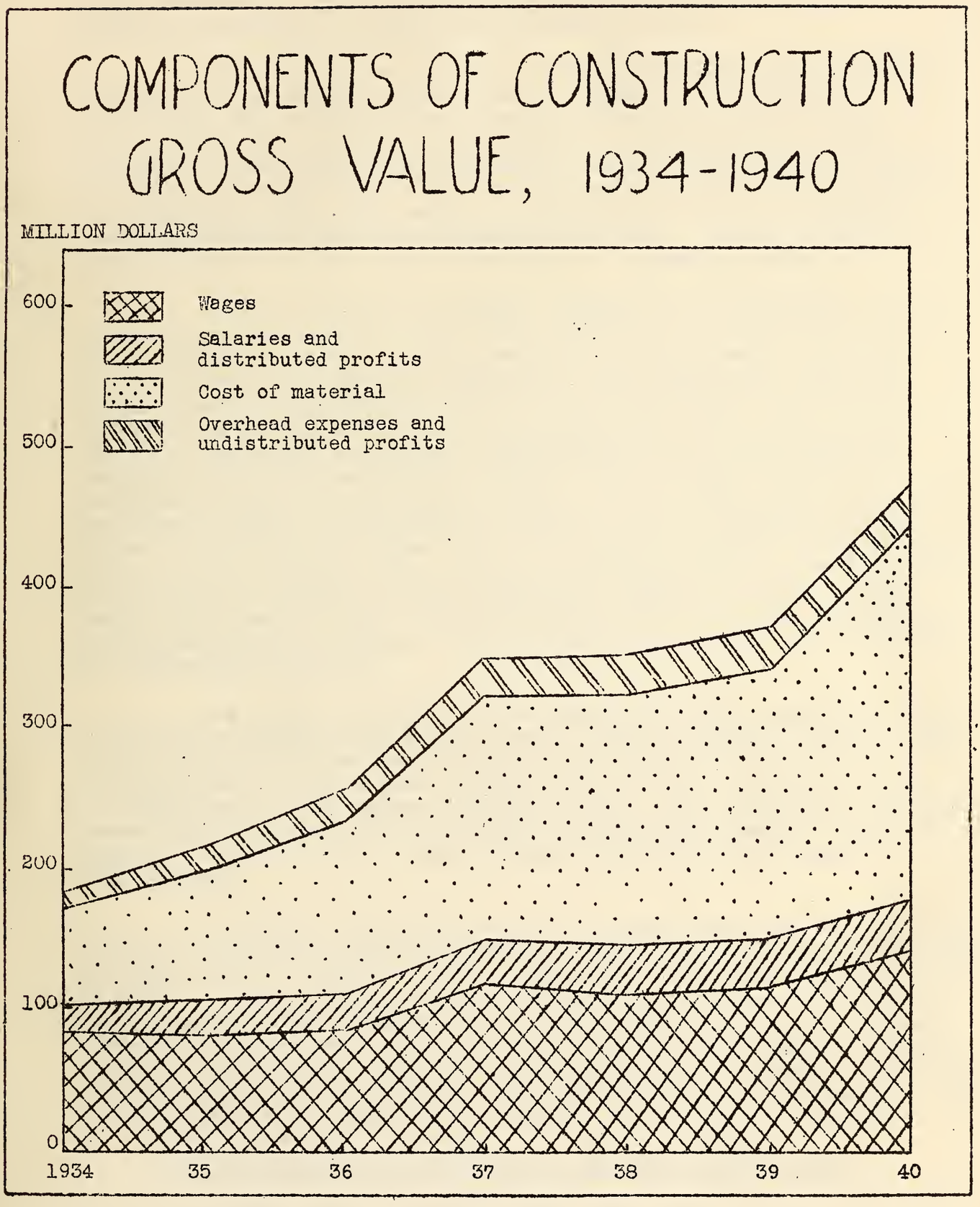

Chart showing in a cumulative way the relative importance of wages, salaries and distributed profits, cost of material, overhead expenses and undistributed profits in construction gross value for the period 1934 to 1940.

increased. Fortunately, this increase of employment does not mean any drainage of our limited supply of skilled construction workers. In other words, it can be assumed that in the post-war era we shall be able, by using the skilled construction labour force available, to give employment to a greater number of unskilled or semi-skilled men simply because the demand for construction materials and transportation services increases at a greater pace than the demand for persons, whether skilled or unskilled, in construction industry proper.

Since the figures under the heading "salaries" include distributed profits, we can not use them for the purpose of indicating the remunerations paid to salaried personnel in the construction industry. We can, however, use wage data for the purpose of indicating the average earnings of a wage earner in construction industry proper during 1934-40. The term "wage" might give rise to some misunderstanding. The Construction Census includes under wages the remuneration paid to employees and working proprietors who work on their own account. It will be useful to bear this point in mind when considering the following comparison.

For the purpose of analysing employment and remuneration in the construction industry, the years 1935 and 1940 have been selected. The year 1935 was the first one during which this country began to pull out of the depression of the early thirties. The Construction Census was standardized during this year and it therefore provides us with better material for purpose of comparison with other years than 1934 would do. In 1935, $82,607,097 were spent on remuneration for 126,098 gainfully occupied persons in construction industry. The average remuneration amounted to approximately $656 por year. It is of importance to note that the actual number of men employed during this year was probably greater since the Construction Census reports only persons employed fully throughout the year. In other words, two men of whom each has been employed half a year would be reported in the Construction Census as one man having worked throughout the year. In 1940, $144,447,805 were spent on payments to 124,020 gainfully occupied persons, the yearly remuneration amounting to approximately $1,165.

The average remuneration for persons gainfully occupied in the construction industry thus varied between $656 in 1935 and $1,165 in 1940. This observation allows the conclusion that an increased volume of construction does not cause necessarily any appreciable change in the field of employment in construction industry proper. On the contrary, experience proves that an increase in the volume of construction brought about a considerable increase in the remunerations of those gainfully occupied in this industry.

A striking complement to this is the fact that the 126,098" wage earners" and 18,670 salaried employees, a total of 144,768 gainfully occupied persons produced a gross value of construction of over 215 million dollars in 1935. In 1940, however, total of 149,830 persons engaged in construction industry proper produced a gross value of over 474 million dollars. Although persons engaged in construction industry proper hardly increased during this period, the value of construction performed increased more than twofold. This fact is of considerable importance for any forecasts of the potentialities of the construction industry for the post-war period.

Construction Material Supplying and Transporting Industries

In 1934, 38.02 per cent of the total value of construction or over 70 million dollars were expended for construction materials and transportation costs. In 1940, these expenditures amounted to 56.36 per cent equal to over 267 million dollars. The question arises what industries participate in these spendings.

Even if the Construction Census gave a complete picture of the types and values of construction materials used throughout one year, it would not allow us to infer that similar proportions of construction materials will be used in a construction program of a different size in one of the following years. The reason is that the types of construction materials used will depend to a great extent on the composition of the construction program. For example, if a great number of concrete paved roads are built, consumption of cement will increase considerably. If, however, a great number of barracks and wooden buildings are erected, as is the case during wartime, requirements for lumber will increase. In order to be able to give a fair appraisal of the requirements for construction materials in the post-war period and thus determine the share of the material supplying and transporting industries in a construction program, it is necessary to determine construction material requirements for the main types of building and engineering construction. (See Section III.)

Such information could easily be secured by surveying the past experiences of a few of the major contractors and a few of the big material supplying companies. If such information were available, it should be possible to give some indication of the impact of a given construction program upon the auxiliary industries in the post-war period. Thus these auxiliary industries could be provided with valuable information enabling them to plan ahead and make preparations in order to meet the demand for construction materials at the conclusion of the war. The industries themselves will certainly appreciate information enabling them to plan ahead a production program because it will avoid uncertainty and waste, the main hindrance of a successfully carried out post-war program. If preparations are made by the material supplying industries to meet increased demands for construction materials, the time of transforming war plants to peace-time purposes or expanding existing plants will be reduced considerably. The sooner the re-tooling program and the process of transformation from war-time to peace-time production can be carried out, the sooner will it be possible to provide employment for the numerous men who will be looking for work after the conclusion of the war.

A substantial sample has been worked out to show the desired breakdown of construction materials used in a one-million dollar expenditure for residential building construction. This is an analysis of figures which cover seven years' administration of the Dominion Housing Act, 1935, the National Housing Act, 1938, and the Home Improvement Loans Guarantee Act, 1937. Over 23,000 housing units were examined. The average cost of the housing unit was established to be approximately $4,000.(1)

The biggest proportion of expenditures for construction materials including transportation costs went to the lumber industry. (See Table III.) The share of this industry amounted to 43.7 per cent of the total expenditure. The next industry was plumbing with 11.03 per cent, followed by the heating industry with 8.52 per cent, the lath and plaster industry (including manufacturers of insulation material) with 7.32 per cent, and the cement, gravel and sand industry with 7.27 per cent. The balance was made up by a number of smaller industries such as paint and glass, brick and stone, roofing material, electrical equipment, tile manufacture, linoleum manufacture and a few other industries.

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(1) "The Labour Value of the Building Dollar", a study prepared by the writer for the Housing Administration, Department of Finance, January 1942.

What is desired, is information of a similar type for all other major types of construction industry such as road construction, bridge construction, electric development, etc. This information, if secured, could be applied to any construction program planned for the post-war period.

Assumed that for the first two post-war years a great program of residential construction is planned and that of the total number of houses to be built, 100,000 houses will cost between $2,000 and $6,000, the average being around $4,000. The carrying out of this portion of the construction program would release an expenditure of 400 million dollars. According to a survey under taken by the writer for the Housing Administration, approximately 220 million dollars would go to the construction material supplying and transporting industries, approximately 140 million dollars would represent remunerations for persons gainfully occupied on construction work at the site, and the balance of 40 million dollars would go to contractors, representing their profits and overhead expenses connected with carrying out such a building program.(1) The 220 million dollars spent for materials would be distributed as follows:

	Million dollars.
Lumber industry	96.1
Plumbing industry.....	24.3
Heating industry	18.7
Lath and plaster industry	16.1
Cement, gravel and sand industry.....	16.0
Paint and glass	12.5
Brick and stone	12.5
Other industries.....	48.1
Total expenditure for construction materials.....	220.0

If such information could be put at the disposal of firms, manufacturing and distributing construction materials, these firms could make preparations in time to meet the increased demand for construction materials in the first few years of the post-war period.

As an illustration, a breakdown of cost of materials including transportation costs used in construction performed by the Dominion Government, provincial governments and municipalities during 1940 is given in Table IV and graphically presented in Figure II. The biggest proportion of 27.71 per cent went to the lumber industry. It is of importantance to note how great the proportion of lumber varies in this breakdown from the breakdown secured for residential dwellings discussed above. The next biggest industry is the cement, clay, sand, gravel and brick industry amounting to 19.19 per cent. These industries are followed by bituminous material, chemicals and oil amounting to 13.36 per cent; electrical, heating and plumbing supplies with 11.75 per cent; hardware, explosives, paint and painters supplies with 11.75 per cent; and iron and steel with 7.01 per cent. The rest of 11.13 per cent went to a number of smaller industries supplying construction materials. The different proportions of this breakdown of construction materials used and the one for residential dwellings show us why over-all rations cannot be used but separate ratios for the major types of construction projects have to be secured.

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(1) This information is based on a questionaire which has been sent out to fifty contractors known to have been doing considerable residential construction in the past.

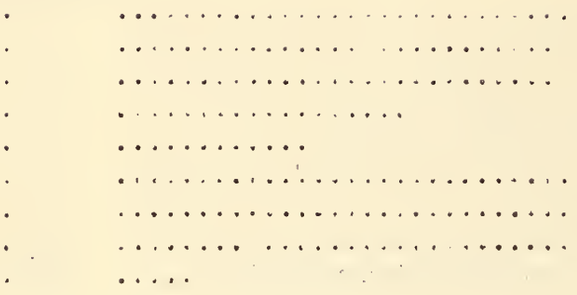


FIGURE II

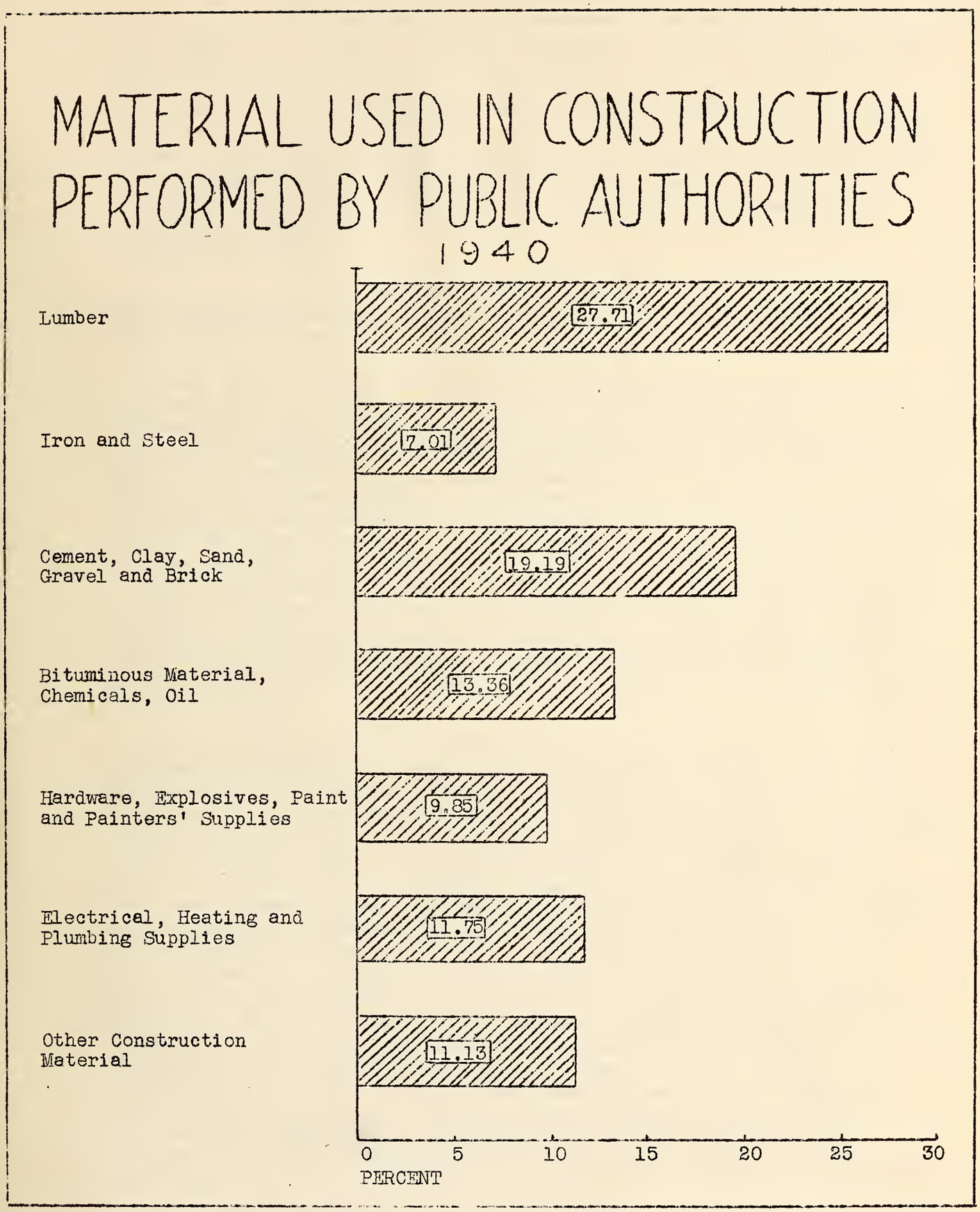


Chart showing the composition of construction material according to selected industries in construction work valued at $39,850,513 undertaken by the Dominion Government, Harbours Board, Provincial Governments and the Municipalities. For sources of statistics see previous table.

III. THE MAIN COMPONENTS OF CONSTRUCTION INDUSTRY PROPER

The composition of a construction reserve for the post-war period will depend on a number of factors. Consideration will have to be given, for example, to the usefulness of the project in the locality in which it is going to be carried out, to the field of employment created by the construction project, to the requirements for construction materials and machinery necessary to carry out the construction project economically. It is obvious that these problems will vary with the different types of construction projects. Some indication of the problemsinvolved might be obtained by studying the main components of building and construction in the past seven years as reported by the Construction Census.

In what follows a distinction between building and engineering construction and building trades (called here "trade construction") will be of importance for the following reasons:

(1) It has already been explained in the previous section that different types of construction projects make different requirements upon the material supplying and transporting industries. Requirements for construction materials by the house building industry will exceed on the whole in volume and in value the requirements for raw materials by road building. Different material requirements will not only exist between building, engineering and trade construction but also between the different types of building construction. For example, material requirements for a group of single family dwellings will differ from the requirements for a large factory building even if the value of both construction projects is equal. Similar distinctions exist between all major types of construction. Only if each of these major types of construction projects is considered will it be possible to give an approximately correct picture of the requirements for construction materials for a given construction program.

(2) An analysis of the different construction projects as to the requirements for skilled, semi-skilled and unskilled labour will show that the ratios of skilled to unskilled labour vary considerably. This is an important factor deserving careful consideration when a construction reserve is being formed. The supply of a skilled construction labour force is limited, while a considerable number of unskilled and semi-skilled labourers will be available after the war. Construction projects which can be handled with comparatively little skilled labour but employ a great number of unskilled or semi-skilled men because of the use of modern machinery, might appear to be desirable for the first two or three post-war years when the primary interest will be to find employment for the great number of returned men and persons released from war factories. It must be quite clear, however, that the greater use of semi-skilled and unskilled labour does not mean a lower standard of workmanship or an un-economical use of manpower. On the contrary, an expanded use of machinery will allow a more economic use of manpower. The pre-fabricated house, increased use of machinery on the site of large building developments, increased use of excavating machinery, bulldozers and other machinery will be the probable answer to meet these requirements.

Recent building development in the United States has proved that such plans can be put into effect. The Alexander's Corner-Housing Scheme in West Virginia, a development which was recently completed, consists of five thousand family units. This development was supposed to be completed within five months but houses were available for use three weeks ahead of schedule. Such a tremendous task could only be completed in the short period of four months and one week because of an extensive use of pre-fabricated parts for the house building and because of a great use of machinery on the site. Practically no sawing or

drilling was done by hand. Mass production methods were used to complete the parts on the site. Machinery was installed near the place where the houses were built and moved to another site when houses were completed near the location where the machines had been installed. The most striking feature of this building development was the fact that the number of unskilled and semi-skilled men, the latter being trained within one week, increased considerably the number of skilled men used on the construction job. This is just the opposite picture of the one presented today by small scale building construction.

(3) An analysis of the construction program in the past might give also some indication of what would be the appropriate share of building, engineering construction and trade construction in any construction program planned for the post-war period. It is evident that the composition of construction undertaken during the war years cannot be accepted as a pattern since military needs and not civilian needs were the governing factor in determining the types of construction projects.

(4) A study of the trend of building, engineering and trade construction will show that fluctuations in building construction are considerably greater than in the other two components of construction. These marked fluctuations in building construction might make increased government regulation necessary simply because serious fluctuations in this particular type of construction are highly undesirable and cause serious repercussions in related fields.

The reasons why a distinction between new construction and alterations and repair construction is advisable are similar to those given above. They may be summed up as follows:

(1) The proportion of labour to material varies between new construction and alterations, and repair constructions. Because of an increased use of machinery in new construction, the expenditure under the heading "materials" will be greater for new construction than for repair construction. On the other hand, repair construction requires more work by the individual craftsman. Thus expenditure for labour on the site will be greater for alteratings and repair construction than for new construction.

(2) Because very little use can be made of machinery in repair construction, more skilled labour will be used for this type of construction than for new construction.

(3) For the reason described above, the value of construction work performed by one construction worker per year will be greater for new construction than for alterations, and repair construction.

(4) An analysis of data available shows that repair construction experienced much less marked fluctuations than new construction.

Building Construction

Building construction increased from over 51.9 million dollars in 1934 to over 257.8 million dollars in 1940, an increase of 396 per cent over the 1934 level. (See Tables V and VI). The trend of engineering construction and trade construction is quite a different picture. Engineering construction increased from over 111.4 million dollars in 1934 to over 164.8 million dollars in 1940, an increase of 126.3 per cent. The great increase of building construction during the seven-year period reviewed is quite striking. (See Table VII and Figure III.) Fluctuations among the two other components of construction industry are much less marked. The sudden upward trend of building construction following in 1935 is important because it can be

FIGURE III

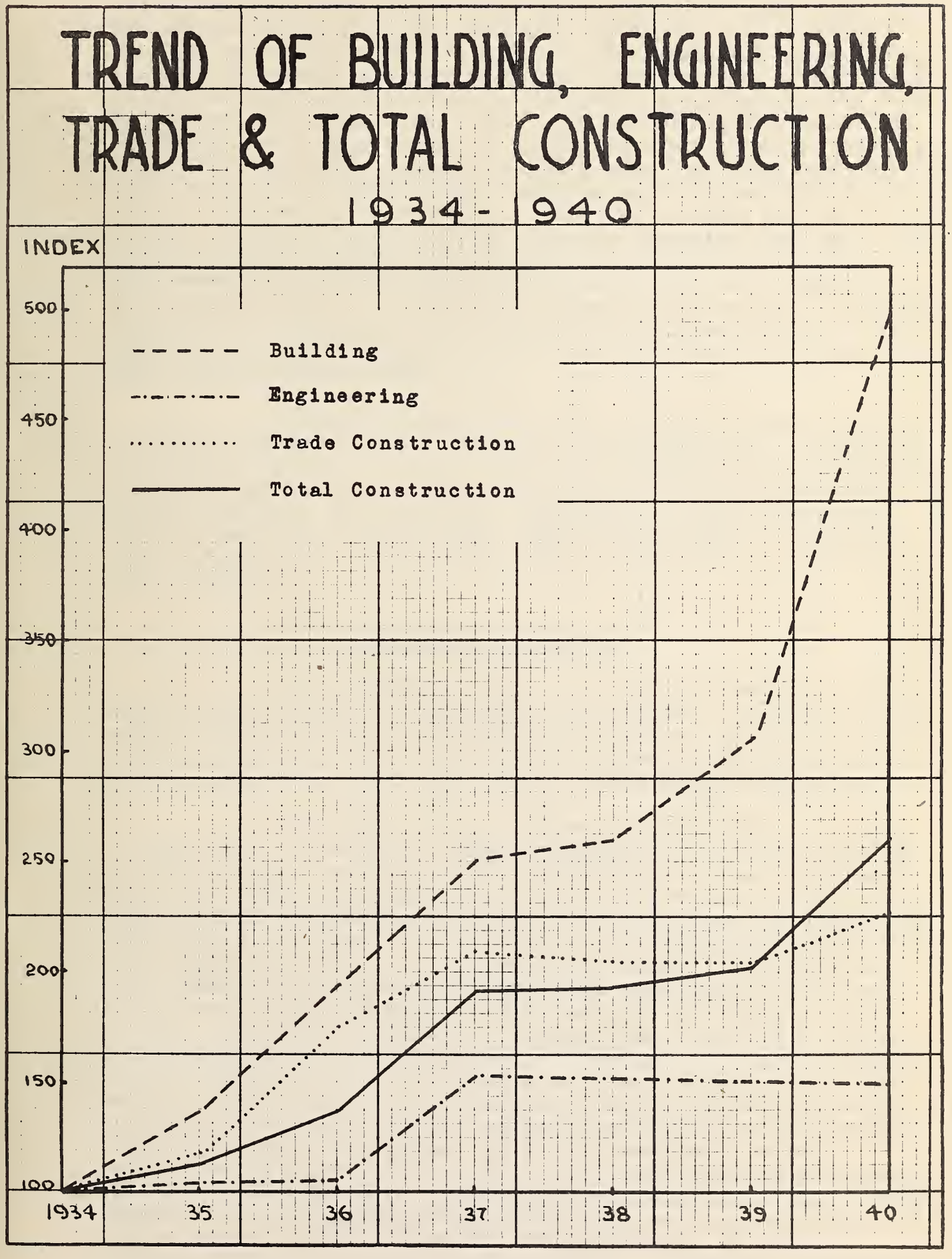


Chart showing a comparison of building, engineering, trade construction and the total value of construction by index numbers for the period 1934 to 1940. Base : 1934 = 100.

FIGURE III

Chart showing a comparison of building, engineering, trade construction and the total value of construction by index numbers for the period 1934 to 1940. Base : 1934 = 100.

assumed with reasonable safety that a similar trend in a reverse direction will be noticed once the downswing phase of the construction cycle is reached.

The Construction Census mentions, as the major types of building construction: residential, institutional, commercial, industrial and other building construction. Residential construction refers to urban and rural house building. It increased from over 13.9 million dollars in 1934 to 59.0 million dollars in 1940 (see Table VIII and Figure IV). For institutional construction including churches, hospitals, etc. over 7.5 million dollars were spent in 1934, over 22.5 million dollars in 1938 (peak) and over 17.2 million dollars in 1940. Commercial construction including office buildings, warehouses, etc. increased steadily from over 9 million dollars in 1934 to over 41.7 million dollars in 1940. Industrial construction increased from over 7.9 million dollars in 1934 to over 40.7 million dollars in 1937. It declined to over 28.8 million dollars in 1938. It reached over 36.6 million dollars in 1939 and jumped considerably to over 80.6 million dollars in 1940. This great increase of industrial construction from 1939 to 1940 gives some indication of the industrial expansion which Canada underwent in the short period of one year. Industrial construction in 1940 was ten times the size of that in 1934. Building construction not otherwise specified shows only a small variation during the period 1934 to 1939, being lowest in 1938 with approximately 5.4 million dollars and highest in 1935 with approximately 18.5 million dollars. A considerable increase is noticeable in 1940 when it amounted to over 54.2 million dollars. This increase is due to considerable military construction which could not be included in the other main branches analysed above.

During the seven-years' period analysed residential construction increased over the 1934 level by 328.8 per cent, institutional construction by 129.4 per cent, commercial construction by 362.3 per cent, industrial construction by 908.2 per cent and other building construction by 333.1 per cent. Total building construction in 1940 increased by 396.2 per cent over the 1934 level. The different types of building projects, the total of which make up building construction, is shown for 1940 in Table IX.

Engineering Construction

The Construction Census distinguishes between the following seven main branches of engineering construction: (1) streets, highways, etc., (2) bridges, viaducts, etc., (3) watermains, sewers, etc., (4) dams, reservoirs, etc., (5) electric stations and transmission lines, (6) docks, wharves, piers, etc., (7) other engineering construction.

The biggest share of engineering construction consisted of expenditure for street and highway construction. With the exception of 1940 over 50 per cent was spent for this purpose in the period under review (see Table X and Figure V). Only about 37 per cent of the total expenditure for engineering construction went to streets and highways in 1940. Thus the existence of a backlog of street and highway construction is distinctly indicated. In 1940 street and highway construction and dock, wharf and pier construction show a decrease from the 1934 level. In the former case it amounts to 1.3 per cent, in the latter to 42.2 per cent. The other main branches of engineering construction show in 1940 an increase over the 1934 level. It amounted for bridges and viaducts to 31.8 per cent, for watermains and sewers to 4.8 per cent, for dams and reservoirs to 21.7 per cent, for electric stations and transmission lines to 1023.2 per cent and for other engineering construction to 127.6 per cent. The increase of electric development of over a thousand per cent above the 1934 level is the most outstanding feature of the increase of expenditure for engineering construction during the period reviewed. Total engineering construction increased from over 111.4 million dollars in 1934 to over 163.8 million dollars in 1940, an increase of 47.8 per cent over the 1934 level. A breakdown of engineering construction according to types for 1940 is shown in Table XI.

FIGURE IV

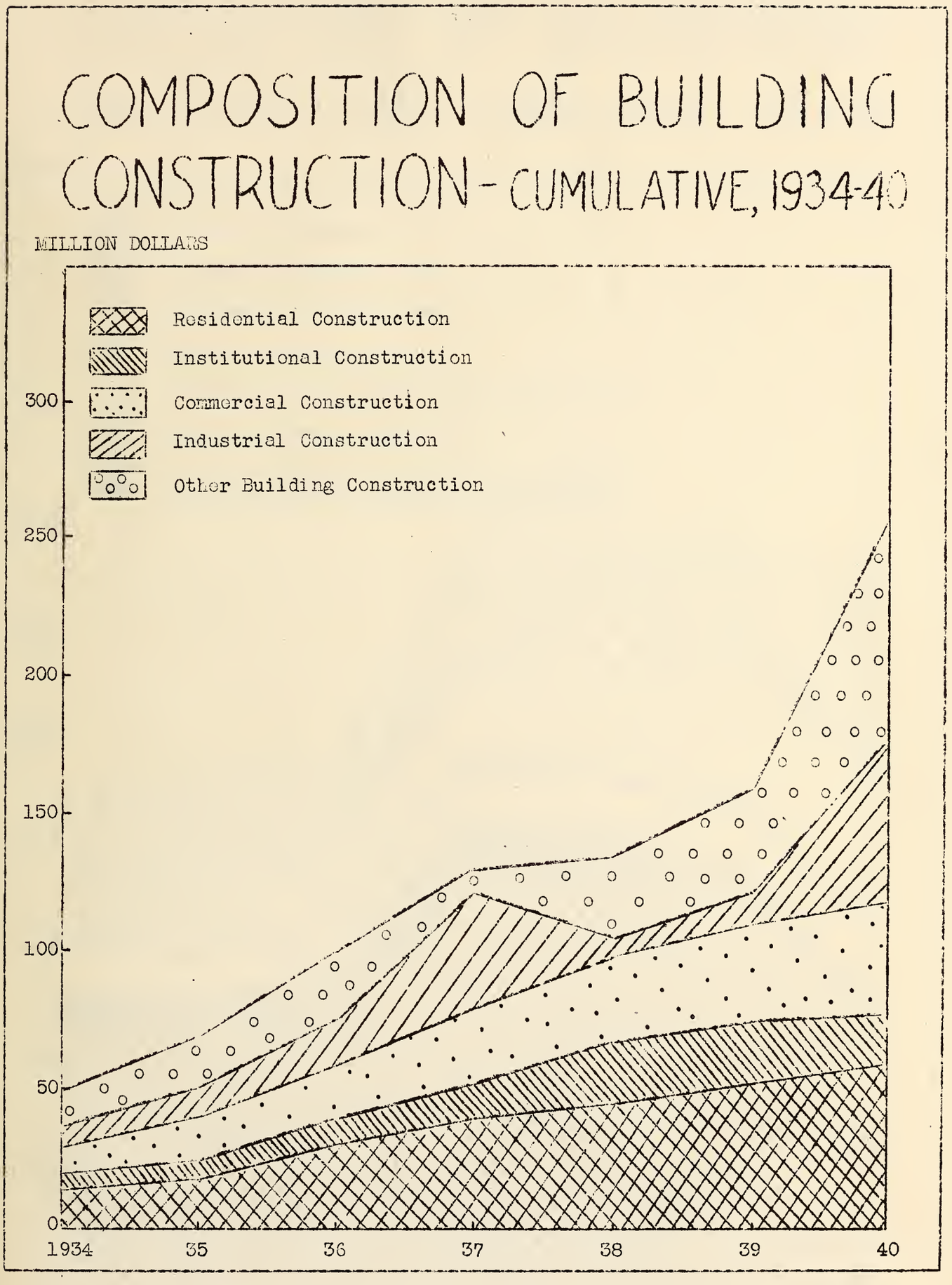


Chart showing in a cumulative way the five main branches of building construction for the period 1934 to 1940.

FIGURE V

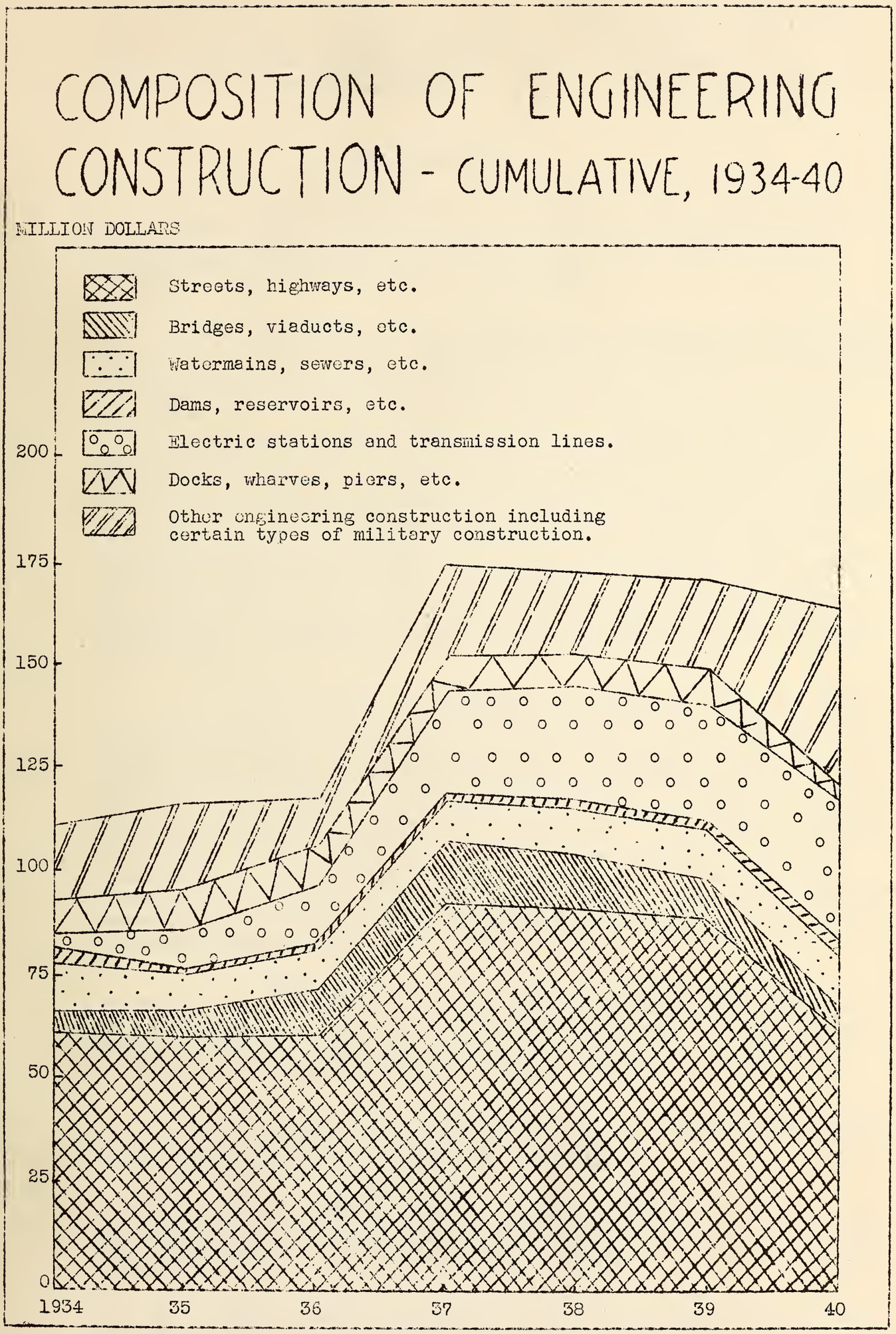


Chart showing in a cumulative way the seven main branches of engineering construction for the period 1934 to 1940.

A comparison of the increase of building and engineering construction in 1940 over the 1934 level shows a marked difference in trend. Building construction increased by 396.2 per cent; engineering construction increased by 47.8 per cent. A similar picture with a reversed trend in the downswing phase of the business cycle must be expected. The need for government assistance, particularly for building construction, is clearly indicated.

Trade Construction

Trade construction is subdivided in the following eight main branches: (1) electrical work, (2) plumbing, heating and air conditioning, (3) brick, masonry and concrete work, (4) carpentry, (5) painting, decorating and glazing, (6) lathing, plastering and stucco, (7) roofing work, (8) other trade construction.

An analysis of the figures contained in the Construction Census for the period 1934 to 1940 shows that an expansion of construction activity affects the various trades to a different degree (see Table XII). The biggest increase is shown for lathing, plastering and stucco. It amounted in 1940 to 338 per cent over the 1934 level. It was followed by roofing work with 260 per cent, electrical work with 164,3 per cent, plumbing, heating and air conditioning with 143.3 per cent, painting, decorating and glazing with 137 per cent, carpentry with 106.3 per cent and other trade construction with 77.9 per cent. Practically no increase was reported by the Construction Census for brick, masonry and concrete work, the percentage being only 2.9. The total increase of trade construction in 1940 over the 1934 level amounted to 126.3 per cent. Thus trade construction ranges, as far as the increase of expenditures in 1940 over the 1934 level is concerned, between engineering and building construction. A breakdown of trade construction according to types for 1940 is shown in Table XIII.

The information contained above gives us some indication of how the different trends are affected by an increase in construction expenditure. The above percentages are by no means solely indicative of changes in the volume of trade construction. They should rather be regarded as a major sample. We have to bear in mind that the Construction Census does not cover the whole field of construction activity. Trade construction is mostly carried out by small men. It is this field where the coverage of the construction census is lowest because of the impossibility of tracking down all small working proprietors doing construction work, especially when the volume of work done is less than one thousand dollars a year. It is important to bear this qualification in mind when considering the above mentioned data.

The Construction Census does not provide information on the labour contents of building, engineering and trade construction. In other words, we do not know who many men were employed to produce the values of building, engineering and trade construction analysed above. We can, however, establish the following principles:

(a) There is more skilled labour required for building construction and trade construction than in engineering construction because engineering construction allows a greater use of machinery.

(b) Because of the greater use of unskilled workers, the expenditures for wages paid to persons employed on the site of engineering construction projects will be lower than for the other two main branches of construction.

(c) Because of lower wages paid to unskilled persons employed on the site, a given expenditure for engineering construction will provide on an average a greater number of man-hours than the same expenditure for building and trade construction.

It might be useful to bear these principles in mind when the employment angle of a construction reserve is considered.

New Construction and Alterations and Repairs

The question might arise after the war whether new construction or alteration and repair construction deserve greater public interest. The analysis below endeavours to show that the fluctuations of new construction are considerably greater than those of alterations and repairs. It follows that it will be mainly new construction which will require the attention of the government.

New construction amounted to over 115.9 million dollars in 1934. It increased to over 352.3 million dollars in 1940. (see Table XIV and Figure VI). The increase in 1940 amounted to approximately 200 per cent over the 1934 level. New construction varied between 62.29 per cent in 1934 and 74.3 percent in 1940, the balance made up by alterations and repair construction. Alterations and repair construction increased from over 70.2 million dollars in 1934 to over 121.8 million dollars in 1940. This amounts to an increase of approximately 75 per cent in 1940 over the 1934 level. A comparison of the percentage increase of 200 per cent for new construction and 75 per cent for alterations and repair construction show quite clearly why government regulation will be more necessary for new construction than for alteration and repair construction. If the construction cycle is considered to be the resultant of two cycles, namely a cycle presenting new construction and a cycle presenting alterations and repair construction, then it will be found that the fluctuations of the alterations and repair construction cycle are much less marked than those of the new construction cycle. There are no figures available indicating the size of the new construction cycle and the alteration and repair construction cycle during the downswing phase of the business cycle, 1929 to 1933. It can however, be safely assumed that the form of the construction cycles in the downswing phase will be reversed to that shown in the upswing phase. If that is the case, the necessity of reducing the wide fluctuations in new construction by appropriate public action becomes self evident.

FIGURE VI

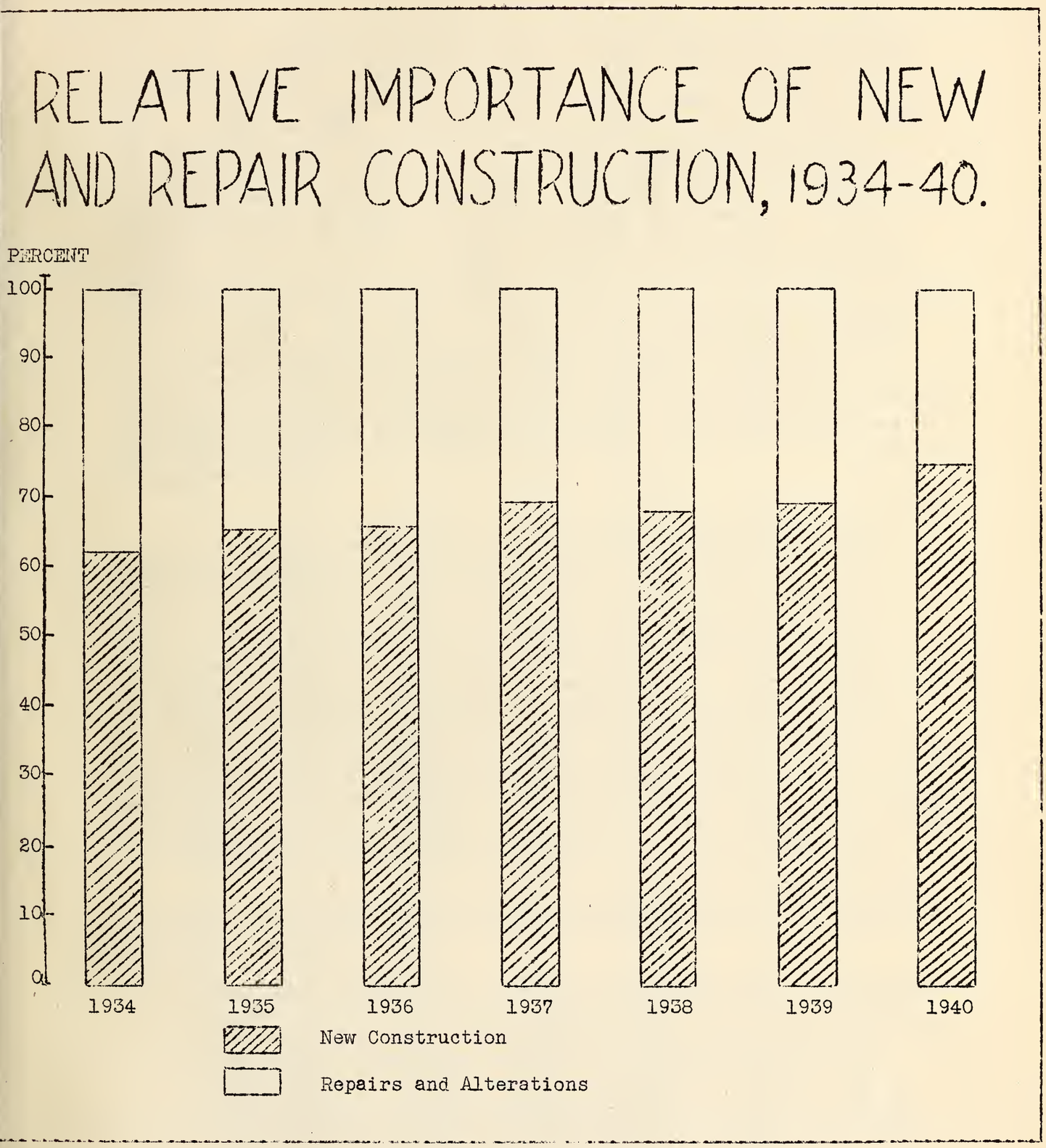


Chart showing the relative importance of new construction and repairs and alterations expressed in percentages of total value of construction for the period 1934 to 1940.

IV. CONSTRUCTION PERFORMED BY PRIVATE CONTRACTORS AND THE PUBLIC AUTHORITIES

A study of the varying proportions of construction work undertaken by private contractors and the public authorities shows that there is no truth in the claim made by some sources that construction work is carried out to an increased extent by the public authorities. The facts show the opposite to be true.

Construction work performed by general, trade and sub-contractors amounted to 53.33 per cent of total construction performed in 1934 (see Tables XV and XVI and Figure VII). This percentage rose to 80.08 in 1940. Construction work by the public authorities made up 46.67 per cent in 1934. It decreased to 19.92 per cent in 1940. These figures prove beyond a doubt that construction performed directly by the public authorities has declined in importance as compared with the work entrusted to private contractors. It bears emphasis, however, that this decline of construction work performed directly by the public authorities does not mean a decline of public construction. On the contrary, there is hardly any doubt, even if no survey has been undertaken yet, that public construction or public inspired construction has increased considerably since the depression hit the country in the early thirties. Public construction is the total of construction performed by the public authorities themselves and by private contractors for the account of the public authorities. Public inspired construction is construction which has been generated by loans, tax reductions and other incentives accorded to the public; for example, The Dominion Housing Act, 1935, The Home Improvement Guaranty Loans Act, 1937, and The National Housing Act, 1938.

Only because we lack information as to the size of public and public inspired construction, are we unable to appraise at the moment the importance of the expenditure of public funds upon the recovery of the construction industry. Since there is no doubt that public construction and public inspired construction will play an important part in post-war reconstruction the importance of a survey for determining the volume of public construction as outlined in Preliminary Report No I can hardly be overemphasized. The importance of the study can perhaps be realized by looking at the figures in Table XV. Construction work undertaken by private contractors amounted to over 379.6 million dollars in 1940, while only approximately 94.5 million dollars were spent on construction work performed directly by the public authorities. It can be assumed with reasonable safety that construction work performed by private contractors for the public authorities exceeds the construction work undertaken directly by the public authorities.

A few points of interest indicating the different impact of construction expenditure by private contractors and by the public authorities are given below:

(1) The public authorities, as far as they undertake construction work themselves, are more concerned with alterations, maintenance and repairs than with new construction. Thus, in 1940, the public authorities expended 37.8 million dollars on alterations and repair construction which they undertook themselves. Since there was approximately a total of 121.8 million dollars spent on alterations and repair construction, the public authorities undertook directly 31 per cent of the total. Of the total of new construction, amounting to approximately 352.3 million dollars in 1940, the public authorities carried out themselves 56.6 million dollars or 16 per cent. We thus find that the share of new construction performed by the public authorities (16 per cent) was much lower than the share of alterations and repair construction (31 per cent).

FIGURE VII

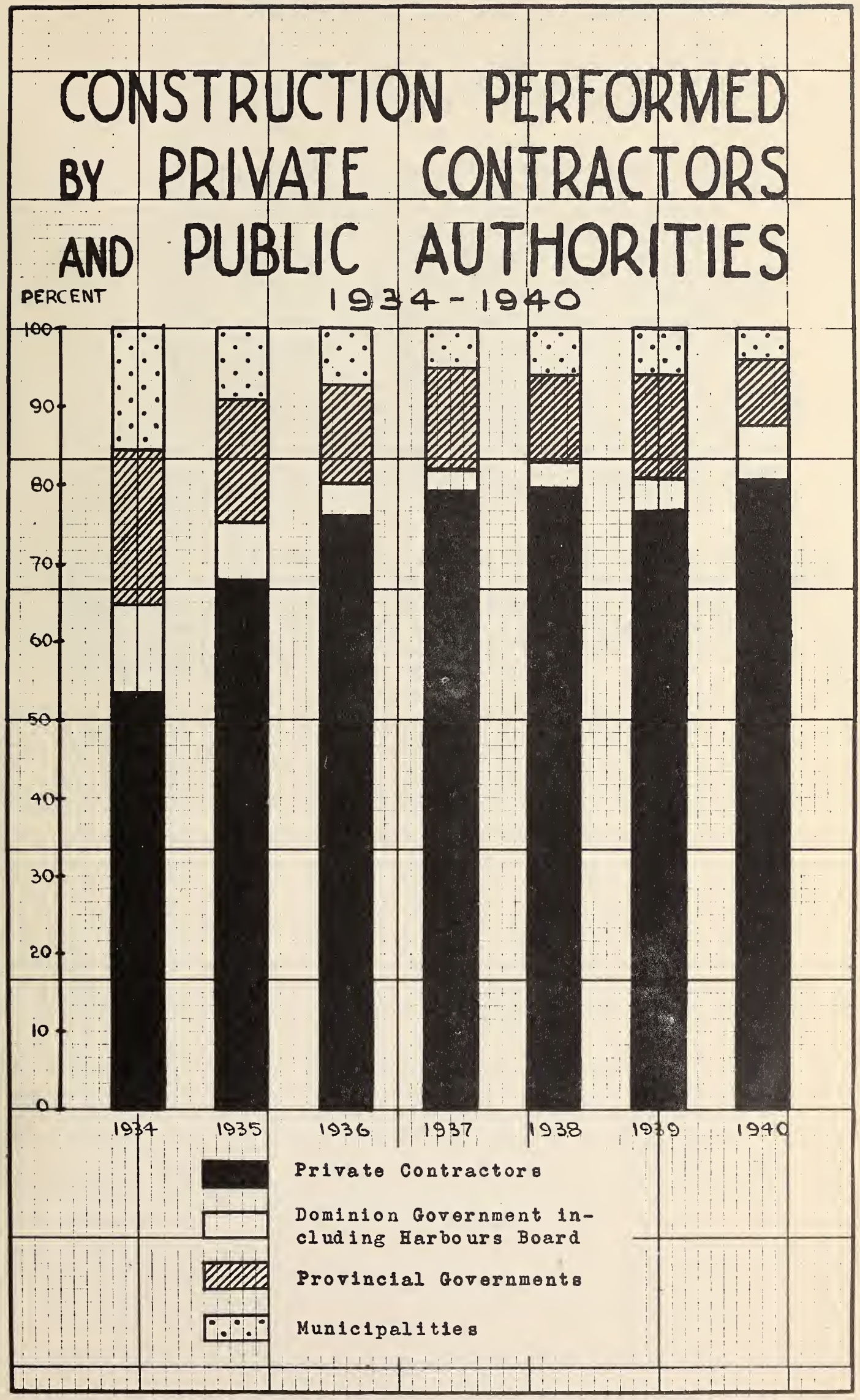


Chart showing the relative importance of construction work performed by private contractors, the Dominion Government including Harbours Board, Provincial Governments and Municipalities for the period 1934 to 1940.

(2) It has been explained in Section III that the value of construction work performed by one construction worker per year varies between new construction and alterations and repair construction because of the increased use of machinery in new construction. Since the public authorities are more concerned with alterations and repair construction than with new construction it is obvious that the value of work performed by one construction worker per year employed by the public authorities will be lower than the value of work performed by a construction worker employed by private contractors.

According to the Construction Census for 1940 a total of 45,932 persons were employed as wage earners and salaried employees producing a total value of construction of approximately 94.5 million dollars. Thus one construction worker employed by the public authorities produced a construction value of approximately $2,057 during the year 1940. In other words the public authorities had to spend $2,057 in order to give employment to one construction worker throughout 1940. In the same year 103,898 persons were reported as salaried employees and wage earners doing construction work for private contractors producing a gross value of construction of approximately 379.6 million dollars. The value of construction work performed by one person employed by private contractors amounted to approximately $3,654. It means that $3,654 had to be expended in order to accord full employment to one person employed by private contractors.

The points mentioned above are some of the features which distinguish construction work undertaken by the public authorities from construction work performed by private contractors. This information might be useful for the purpose of planning what proportion of construction work should be undertaken by the public authorities directly and what proportion by private contractors.

V. COMPLEMENTARY CONSTRUCTION

It has been emphasized that primary employment created by the completion of a construction project does not represent the total of employment created by a given construction expenditure. There are other effects of construction expenditure which are usually called secondary effects.

Secondary effects will include additional employment created by the necessity of maintaining or adding additional structures to the construction project completed, as well as employment created in certain appliance and consumer goods industries (see Report I).

The present analysis is concerned only with one aspect of the secondary effects of construction, namely the need for additional construction caused by the completion of a certain construction project. This additional construction necessary is complementary to the construction project already carried out. The employment thus created may therefore be described as "complementary employment", a term entirely different from the expression "secondary employment". The latter term refers to the effects of primary employment in the producer goods industries (including the construction industry) upon the consumer goods industries while the former term refers to additional employment created within the construction industry itself. For example, a newly built road will require additional work in order to maintain it. This is, however, not the full story of additional construction work involved. The road will be used by motorists. Service and repair stations will be built along the road. Road caterers will erect stands to serve the tourists. The new road might open up a country hitherto undeveloped. New houses might be built and small communities come into existence along the new road. All this additional new construction would not have come into existence if the new road had not been built. To indicate what importance complementary construction can attain, a conduits construction job is analyzed in the following.

It is endeavoured to show that after the conduits construction job was completed there was considerable other construction work to be undertaken directly in consequence of the initial construction project. Conduits are used for the purpose of preservation of cables laid under the ground. Conduits construction has become an important factor in the modernization of cities where overhead wiring systems are replaced by underground wiring systems.

On the 16th November, 1935, the Electrical Commission of the City of Montreal commenced preparing plans for a conduit system in District No. 28 of Montreal. A firm of contractors commenced work on the job on October 2, 1936, which lasted to January 15, 1937, was interrupted then until April 29, 1937, when work was commenced again and completed on October 9, 1937. The completion of the construction work took approximately one year. A breakdown of the construction work involved and material used is shown in Tables XVII and XVIII. Of the total cost of the construction project 35.7 per cent went into labour, 47.6 per cent into material, and 15.7 per cent into overhead expenses, including salaries for off-site employment, such as work by engineers, draftsmen, etc., and financial charges (see Table XIX). According to the estimates of the Electrical Commission 236,776 man hours were provided by the above mentioned construction job, on-site and off-site employment sharing equally the employment created (see Report I, pp. 77 ff.)

TABLE XIX

SUMMARY OF A CONDUITS CONSTRUCTION JOB IN MONTREAL, 1936 - 1937.

Cost of labour	49,879.56 dollars	35.7 per cent
Cost of materials	66,430.32 "	47.6 "
Salaries of staff of the Electrical Commission and overhead expenses including financial charges	23,895.61 "	15.7 "
Total	140.205.49 dollars	100. per cent

On-site employment	118,400 man hours
Off-site employment	118,376 " "
Total employment provided	236,776 man hours

On-site and off-site man hours provided by this construction project were approximately equal. On the whole off-site employment exceeds on-site employment. The fact that this particular conduits construction job is an exception to the rule can be explained by the large proportion of unskilled labour which was used in the construction of conduits. Out of the 118,400 man hours of on-site employment, 77,952 man hours were made out of unskilled work. The wage rates for unskilled labourers in the province of Quebec are lower than in other provinces. Rates amounted on an average to 35 cents per hour in the years 1936 and 1937. A great part of the construction material used on the construction job, for example fibre ducts, came from other provinces than Quebec. The wage rates paid for factory workers were on the whole higher than the rates paid to the common labourers in Montreal. Furthermore, there are included in off-site employment the salaries paid to the Commission staff, including engineers, inspectors, draftsmen and administrative staff. The earnings of this group of people were considerably higher than the average earnings of persons employed on the site.

After the conduits construction job was completed certain other construction work became necessary. The Electrical Commission made an approximate estimate of additional expenditures which had to be made following the completion of the conduits construction job, of which a short summary follows:

(1) Over 113,000 feet of cables were installed for use underground.

(2) 122 street lights, police, fire and traffic standards were installed.

(3) 409 buildings were rewired for new underground service.

(4) 232 poles and the communicating wires were removed.

It is estimated that expenditures for the above mentioned additional construction work amounted approximately to $250,000; that is, approximately $110,000 more than the initial expenditure for the conduits construction. While it took about one year to complete the construction of the conduits, it took about three years to complete the additional construction work required.

This analysis suggests how important it is to consider construction projects not only from the angle of immediate creation of employment but also from the angle of what complementary construction might follow an initial construction expenditure.

VI. CONSTRUCTION IN THE PROVINCES

The need for a construction reserve for the post-war period has been repeatedly emphasized. There is hardly any doubt in responsible quarters that such a construction reserve will have to be well planned ahead by the Dominion Government. One of the questions which will arise will be the most appropriate geographical distribution of this construction reserve. A few of the factors which might assist in forming policy may be gleaned from an analysis of construction work undertaken by the provinces in the past. Concern is given here only (1) to a breakdown of gross value of construction according to the provinces and (2) to per capita construction value according to provinces.

Gross Value of Construction by Provinces

It has been emphasized that the Construction Census was not standardized before 1935. The difficulty of bringing the figures for 1934 into proper relationship with the series beginning in 1935 was due to the fact that approximately 10.8 million dollars of construction work performed were not segregated according to provinces. The accuracy of the breakdown of gross value of construction by provinces for 1934 is probably not too much impeded by the lack of a breakdown for the 10.8 million dollars since the total gross value of construction for which the breakdown was available, amounted to approximately 175.4. The total gross value of construction reported for 1934 amounted to $186,198,890. To make the breakdown for 1934 more complete, the residue of 10.8 million dollars was broken down according to the share of the construction gross value by provinces, the figures for which were available in the Construction Census for the sum of 175.4 million dollars.

The biggest proportion of construction was carried out in the province of Ontario. The share of this province varied between 38.81 percent in 1939 and 51.8 percent in 1934, the yearly average being 42.9 percent (see Tables XX and XXI and Figure VIII). The share of Quebec varied between 23.03 percent in 1934 and 31.77 percent in 1939, the average amounting to 27.49 percent. The next biggest proportion of construction was performed in British Columbia, varying between 5.24 percent in 1934 and 8.93 percent in 1937, the average per year being 7.42. Nova Scotia followed next, its share being lowest in 1938 with 5.11 percent and highest in 1935 with 7.62 percent, the annual average being 5.82 percent. The next group is composed of Manitoba, New Brunswick and Alberta whose annual average of construction was of similar size: Manitoba - annual average 4.31 percent, Alberta - annual average 4.28 percent, and New Brunswick - annual average 4.08 percent. The balance of construction undertaken in Canada was made up by Saskatchewan with an annual average of 3.27 percent and Prince Edward Island with an annual average of .43 percent. For the purpose of completion it may be said that construction undertaken in the Northwestern Territories is included in Alberta while construction undertaken in the Yukon is included in British Columbia.

It appears that the average percentages of construction work undertaken in the provinces during the seven years period analyzed might give some guidance to those charged with forming a policy of distributing equitably construction amongst the provinces. Some might claim, however, that the need for military construction and other construction necessitated by the process of industrialization due to the war has boosted expenditures for construction purposes unequally among the provinces. To meet this comment, the average annual share of construction performed in the provinces is given for the period 1934-1938, thus excluding the war years:

FIGURE VIII

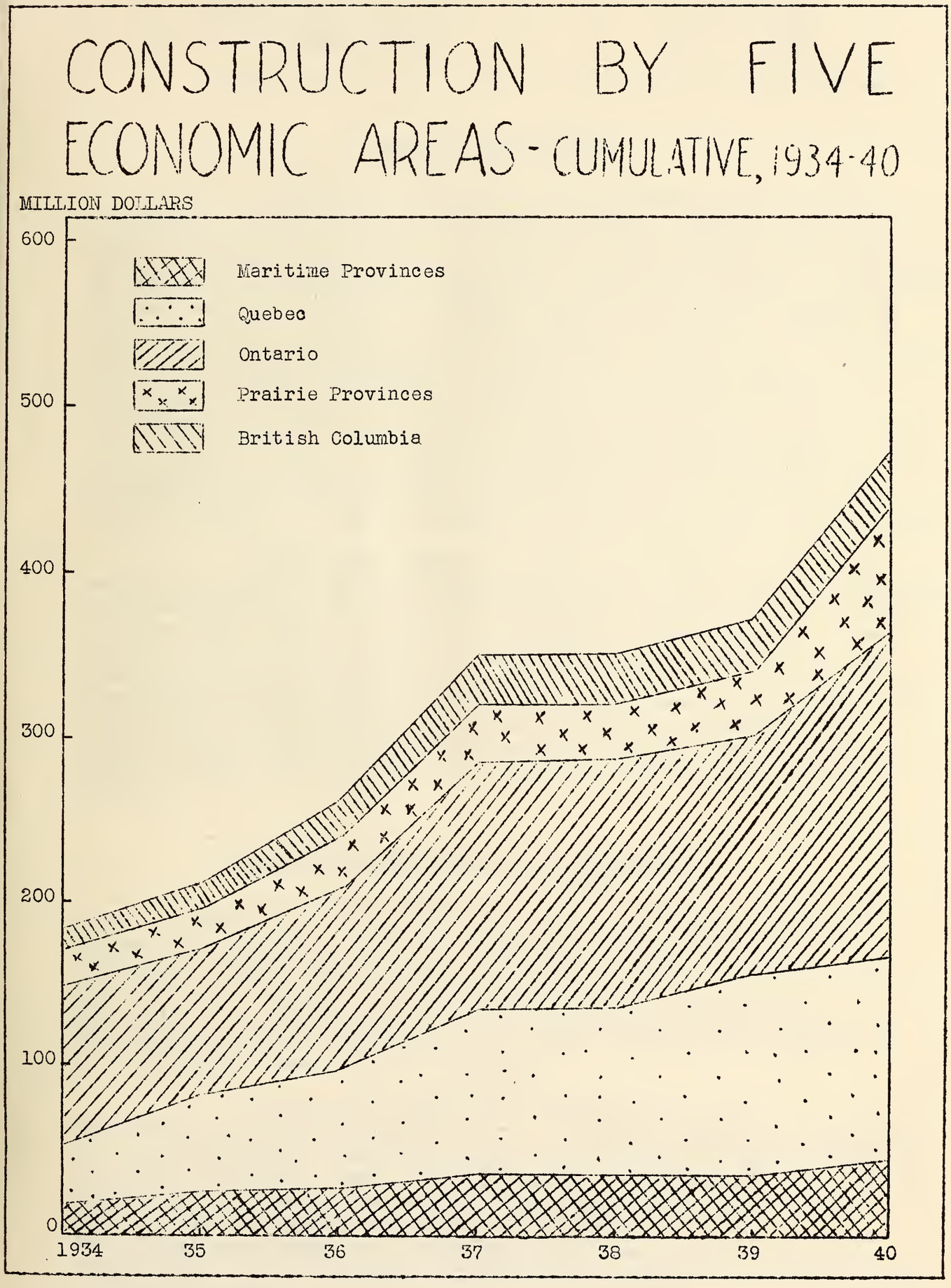


Chart showing in a cumulative way the gross value of construction by five economic areas for the period 1934-1940.

(1)	Ontario	annual average	44.18	percent.
(2)	Quebec	" "	26.75	"
(3)	British Columbia	" "	7.48	"
(4)	Nova Scotia	" "	5.88	"
(5)	New Brunswick	" "	4.37	"
(6)	Manitoba	" "	4.17	"
(7)	Alberta	" "	3.88	"
(8)	Saskatchewan	" "	2.96	"
(9)	Prince Edward Island	" "	.33	"
	Canada		100.00	percent

Trend of Construction

Construction fluctuated less in Ontario than in other provinces. The variation in seven years amounts to 99.37 points. On the whole the trend of construction is similar in New Brunswick (see Table XXII). New Brunswick is the only province where a decrease of construction was reported in 1940 from the 1939 level. Nova Scotia, Quebec and Saskatchewan belong to a group with similar trends. The increase during the seven-year period amounted, for these provinces, to 190.11, 197.32 and 207.6 points respectively over the 1934 level. The next group was composed of British Columbia, Alberta and Manitoba, the increase amounting to 256.34, 263.12 and 297.81 points respectively over the 1934 level. The most marked fluctuations to be noted relate to construction performed in Prince Edward Island, the index jumping from 100 in 1934 to 1360 in 1940. This is mainly due to the fact that considerable military construction was carried out in Prince Edward Island in 1940. The increase of construction for Canada, as a whole, amounted to 154.62 points over the 1934 level.

These index numbers show that the trend of construction varied considerably for the different provinces. This may well be explained by a backlog of construction in the provinces. Some provinces are less developed than others. If they want to develop their resources, more construction has to be undertaken in the future than was done in the past. Less developed provinces would therefore show a trend of construction undergoing greater fluctuations than more highly developed provinces. This factor will have to be taken into consideration when considering the assistance which the Dominion Government might give to the provinces in order to enable them to carry out construction projects in the post-war period.

Construction Per Capita for the Provinces

It has been claimed that attention should be paid to the value of construction per capita when considering a distribution of construction projects amongst the provinces. In order to provide information on this topic two years have been selected: 1938 as the last pre-war year and 1941 as the latest year for which information is available. The following analysis is based on preliminary figures and is subject to further revision at such a date when the final figures of the Population Census 1941 are released.

Construction expenditure per capita was highest in Ontario in 1938 and in British Columbia in 1941. In 1938 construction expenditure per capita amounted to $41.4 in Ontario and to $36.2 in British Columbia including the Yukon. These two provinces were followed with a per capita expenditure on construction of $34.1 in New Brunswick, $32.5 in Nova Scotia, $31.6 in Quebec, $19.9 in Manitoba, $16.8 in Alberta including the Northwestern Territories, $14.4 in Prince Edward Island and $12.3 in Saskatchewan. The construction expenditure per capita for Canada amounted to $31.8 in 1938.

In 1941 the provinces were led by British Columbia with $70.6 followed by Ontario with $69.6, Nova Scotia with $57.9, Quebec with $54.8, Alberta with $44.2. Then followed New Brunswick and Manitoba each with $40.9, Saskatchewan with $23.3 and Prince Edward Island with $20.6. Construction expenditure per capita for Canada as a whole amounted to $56 for 1941.

The great increase of construction expenditure per capita from 1938 to 1941 must be of interest to anyone considering the potentialities of the construction industry. It is admitted that the increase of construction expenditure gives only a rough indication of the increase in the volume of construction because of the use of unadjusted dollar values. Furthermore, a considerable increase of construction activity is due to Canada's industrial expansion on account of the war. Once this country turns from wartime to peacetime conditions there is, however, no need that per capita expenditure for construction should again fall back to pre-war levels. Instead of construction for military purposes the resources of this country can be used for construction for civilian purposes. Instead of military air fields civilian air fields can be built; instead of barracks and temporary office buildings residential dwellings can be erected; instead of military shore installations roads can be constructed.

What is required, is the advance preparation of plans to effect a smooth transformation of wartime construction to peacetime construction beneficial to the country as a whole. It is of utmost importance that it be made clear by the Government to the construction industry and the material supplying industries what will be expected from them in the post-war period so that these industries can prepare for the task ahead of them.

APPENDIX

TABLE I.

RELATIVE IMPORTANCE OF WAGES, SALARIES AND DISTRIBUTED PROFITS, COST OF MATERIAL, OVERHEAD EXPENSES AND UNDISTRIBUTED PROFITS OF CONSTRUCTION GROSS VALUE - DOLLAR VALUES (1).

1934 - 1940

Year	Wages Dollars	Salaries and Distributed Profits Dollars	Cost of Material Dollars	Overhead Expenses and Undistributed Profits Dollars	Total Value of Construction Dollars
1934	84,679,986	16,928,242	70,792,135	13,798,527	186,198,890
1935	82,607,097	22,579,526	94,733,584	15,628,666	215,548,873
1936	87,575,538	25,270,846	122,189,238	23,004,778	258,040,400
1937	120,239,004	30,398,287	175,844,435	25,392,388	351,874,114
1938	112,595,479	34,809,919	176,562,208	29,255,679	353,223,285
1939	118,601,138	34,841,305	189,497,342	30,263,895	373,203,680
1940	144,447,805	35,781,693	267,228,786	26,664,494	474,122,778

TABLE II.

RELATIVE IMPORTANCE OF WAGES, SALARIES AND DISTRIBUTED PROFITS COST OF MATERIAL, OVERHEAD EXPENSES AND UNDISTRIBUTED PROFITS OF CONSTRUCTION GROSS VALUE - PERCENTAGES

1934 - 1940

Year	Wages Percent	Salaries and Distributed Profits Percent	Cost of Material Percent	Overhead Expenses and Undistributed Profits Percent	Total Value of Construction Percent
1934	45.48	9.09	38.02	7.41	100
1935	38.32	10.47	43.96	7.25	100
1936	33.94	9.79	47.36	8.91	100
1937	34.17	8.64	49.97	7.22	100
1938	31.88	9.85	49.99	8.28	100
1939	31.78	9.33	50.78	8.11	100
1940	30.47	7.55	56.36	5.62	100

(1) Data taken from "Report on the Construction Industry in Canada, 1940", published by the Dominion Bureau of Statistics, p. 5.

TABLE III

BREAKDOWN OF CONSTRUCTION MATERIAL USED IN A $1000,000 EXPENDITURE FOR RESIDENTIAL BUILDING CONSTRUCTION(1)

Types of Construction	Cost Value	
	Dollars	Percent
Cement, gravel and sand industry	72,700	7.27
Brick and stone industry	56,800	5.68
Lumber industry	437,600	43.76
Lath and plaster industry including manufacturers of insulation material(2)	73,200	7.32
Tile industry(3)	21,200	2.12
Linoleum industry	12,900	1.29
Paint and glass industry	57,000	5.70
Roofing material industry(4)	37,300	3.73
Plumbing industry	110,300	11.03
Heating industry	85,200	8.52
Electrical equipment industry(5)	34,300	3.43
Miscellaneous	1,500	.15
Total	1,000,000	100.00

(1) Data taken from "Labour Value of the Building Dollar", a study prepared by the writer for the Housing Administration, Department of Finance. The analysis was based on seven years administration of the Dominion Housing Act, 1935, the National Housing Act, 1938, and the Home Improvement Loans Guarantee Act, 1937.

(2) The lath industry will depend on the lumber and steel industry for the supply of wood and steel to manufacture laths. The plaster industry will depend mainly on the sand and lime manufacturers for the supply of the material required.

(3) Some orders going to the tile industry will go to the brick manufacturers since there is some overlapping between tile and brick manufacture.

(4) The roofing industry will depend on the lumber and sheet metal industry, the asphalt and asbestos manufacturer for the supply of the material required. For the construction of flat roofs, tar and gravel will be required.

(5) This industry covers a number of manufacturers of wires, sheet metal, electrical fixtures, accessory manufactures, plastics and rubber manufactures, etc.

TABLE IV

BREAKDOWN OF COST OF MATERIAL USED IN CONSTRUCTION PERFORMED BY THE DOMINION GOVERNMENT, HARBOURS BOARD, PROVINCIAL GOVERNMENTS AND MUNICIPALITIES, 1940. (1)

Types of Construction Materials	Cost Value	
	Dollars	Percent
Lumber	11,030,534	27.71
Iron and Steel	2,796,981	7.01
Cement, Clay, Sand, Gravel and Brick	7,648,244	19.19
Bituminous Material, Chemicals, Oil	5,328,869	13.36
Hardware, Explosives, Paint and Painters' Supplies	3,929,854	9.85
Electrical, Heating and Plumbing Supplies	4,684,426	11.75
Other Construction Material (e.g. plastics, insulation material, etc.)	4,431,605	11.13
Total	39,850,513	100.00

(1) Data compiled from "Report on the Construction Industry in Canada, 1940" published by the Dominion Bureau of Statistics, p. 15.

TABLE V

BUILDING, ENGINEERING AND TRADE CONSTRUCTION - DOLLAR VALUES(1)

1934 - 1940

Year	Building Construction Dollars	Engineering Construction Dollars	Trade Construction Dollars	Total Value of Construction Dollars
1934	51,958,121	111,487,528	22,753,241	186,198,890
1935	71,302,664	117,395,623	26,850,586	215,548,873
1936	100,098,833	118,460,058	39,481,509	258,040,400
1937	130,538,998	173,319,350	48,015,766	351,874,114
1938	134,912,175	171,768,145	46,542,965	353,223,285
1939	159,041,080	168,302,939	45,859,661	373,203,680
1940	257,800,560	164,831,545	51,490,673	474,122,778

BUILDING, ENGINEERING AND TRADE CONSTRUCTION - PERCENTAGES

1934 - 1940

Year	Building Construction Percent	Engineering Construction Percent	Trade Construction Percent	Total Value of Construction Percent
1934	27.90	59.88	12.22	100
1935	33.07	54.48	12.45	100
1936	38.79	45.91	15.30	100
1937	37.10	49.25	13.65	100
1938	38.19	48.63	13.18	100
1939	42.62	45.09	12.29	100
1940	54.37	34.77	10.86	100

(1) Data taken from "Report on the Construction Industry in Canada, 1940", published by the Dominion Bureau of Statistics, p. 5.

TABLE VII

INDEX NUMBERS OF BUILDING, ENGINEERING AND TRADE CONSTRUCTION IN CANADA (1).

1934 - 1940

Year	Building Construction (2)	Engineering Construction (2)	Trade Construction (2)	Total Value of Construction (2)
1934	100.00	100.00	100.00	100.00
1935	137.22	105.29	118.02	115.79
1936	192.65	106.25	173.55	138.56
1937	251.23	155.44	211.08	189.00
1938	259.62	154.07	204.59	189.69
1939	306.08	150.94	201.60	200.43
1940	496.15	147.83	226.33	254.62

(1) Base of Index 1934 = 100.

(2) The computation of the index numbers has been based on statistics contained in the previous table.

TABLE VIII

COMPOSITION OF BUILDING CONSTRUCTION ACCORDING TO FIVE MAIN BRANCHES(1)

1934 - 1940

Year	Residential Dollars	Institutional Dollars	Commercial Dollars	Industrial Dollars	Other Building Construction Dollars	Total Building Construction Dollars
1934	13,972,110	7,501,080	9,030,135	7,997,286	13,457,510	51,958,121
1935	18,522,118	7,310,686	16,776,463	10,176,142	18,517,255	71,302,664
1936	31,265,629	9,216,887	20,560,054	23,636,689	15,419,574	100,098,833
1937	40,675,617	13,590,401	28,768,233	40,781,825	6,722,922	130,538,998
1938	46,423,856	22,539,900	31,596,518	28,890,866	5,461,035	134,912,175
1939	53,926,429	21,214,315	35,100,121	36,654,828	12,145,387	159,041,080
1940	59,925,197	17,208,419	41,748,521	80,624,101	58,294,322	257,800,560

(1) Table compiled from "Report on the Construction Industry in Canada, 1940", p. 5.

TABLE IX

BREAKDOWN OF BUILDING CONSTRUCTION 1940 (1).

Type of Building Construction	Dollars	Percent of Building Construction	Percent of Total Construction
Dwellings, single	43,155,131	16.74	9.10
Dwellings, semi-detached or double ...	4,529,288	1.75	.95
Duplexes	4,139,341	1.61	.88
Apartment houses	8,101,437	3.15	1.71
Hotels, clubs, restaurants, etc.	2,832,270	1.12	.61
Churches and church halls	2,000,574	.77	.42
Hospitals and sanatoria	6,305,996	2.44	1.33
Schools, institutions, etc.	8,901,849	3.45	1.88
Office buildings	10,433,615	4.05	2.20
Stores	9,391,710	3.64	1.98
Theatres and amusement halls	3,124,500	1.21	.66
Factories, warehouses and storehouses.	73,460,739	28.50	15.49
Elevators, grain	10,771,300	4.18	2.27
Garages	2,062,951	.80	.43
Service stations	2,762,579	1.07	.58
Mine buildings	7,163,362	2.79	1.52
Farm buildings	1,165,707	.45	.24
Radio stations	319,596	.12	.06
Armouries and barracks	36,580,751	14.19	7.72
Aeroplane hangars	18,379,614	7.13	3.88
Other building construction	2,168,244	.84	.46
Total	257,800,560	100.00	54.37

(1) Table compiled from statistics contained in the "Report on the Construction Industry in Canada 1940", p. 8.

TABLE X

COMPOSITION OF ENGINEERING CONSTRUCTION ACCORDING TO SEVEN MAIN BRANCHES[1]

1934 - 1940

Year	Streets, Highways, etc. Dollars	Bridges, Viaducts, etc. Dollars	Watermains, Sewers, etc. Dollars	Dams, Reservoirs, etc. Dollars	Electric Stations and Transmission Lines Dollars	Docks, Wharves, Piers, etc. Dollars	Other Engineering Construction Dollars	Total Engineering Construction Dollars
1934	61,254,739	5,454,584	11,708,030	2,991,000	3,002,420	8,295,088	18,781,667	111,487,528
1935	60,094,281	6,659,829	8,870,617	870,326	9,240,027	10,583,150	21,077,393	117,395,623
1936	60,222,073	10,064,552	9,054,340	1,134,120	13,795,377	10,160,697	14,028,899	118,460,058
1937	93,320,022	15,726,839	9,279,550	1,904,123	24,583,530	9,362,133	19,143,153	173,319,350
1938	90,618,078	12,876,724	12,224,898	2,404,864	27,964,296	8,333,588	17,345,697	171,768,145
1939	86,666,394	10,129,546	12,373,948	3,078,673	27,520,189	9,232,258	19,301,931	168,302,939
1940	60,468,279	7,188,649	12,267,214	3,637,190	33,718,009	4,809,671	42,743,133	164,831,545

(1) Table compiled from "Report on the Construction Industry in Canada, 1940", p. 5.

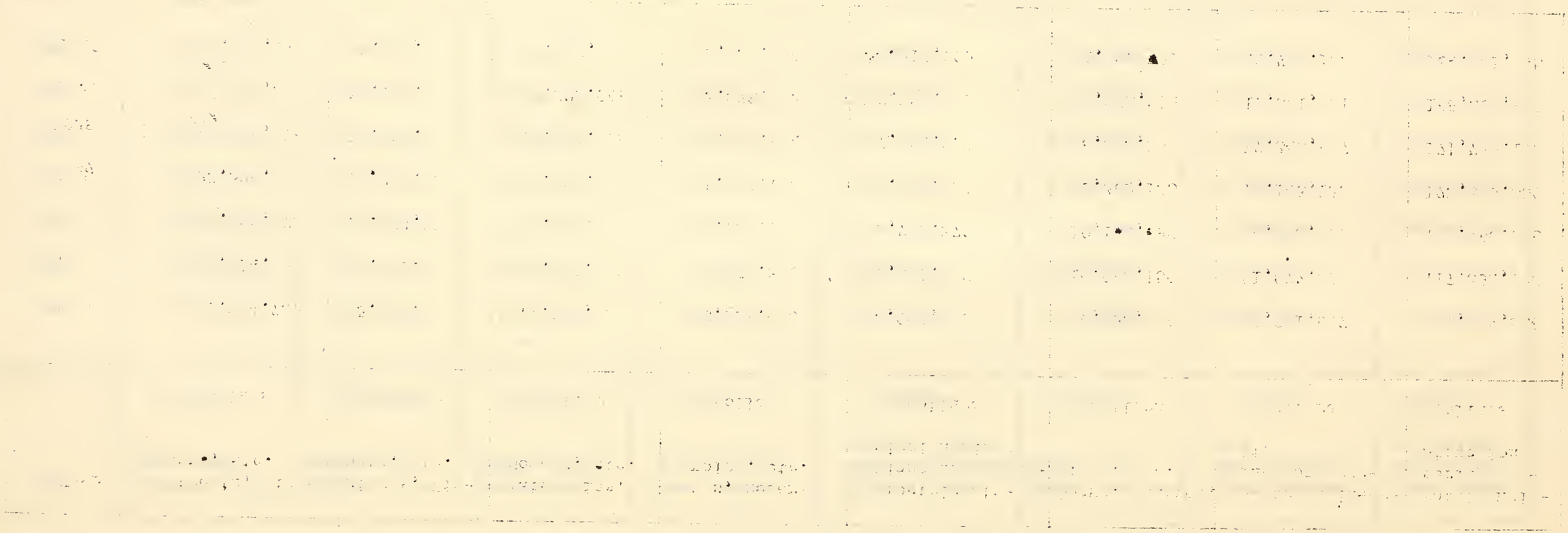


TABLE XI

BREAKDOWN OF ENGINEERING CONSTRUCTION 1940 (1).

Type of Engineering Construction	Dollars	Percent of Engineering Construction	Percent of Total Construction
Hard surfaced or paved streets, highways, etc.	21,708,925	13.17	4.58
Gravel or stone surfaced streets, highways, etc.	22,350,720	13.56	4.71
Dirt or clay roads	3,736,761	2.27	.79
Grading, scraping, oiling, filling, etc.	7,969,822	4.83	1.68
Sidewalks	1,167,233	.71	.25
Roadside maintenance and area improvement	1,877,779	1.14	.40
Bridges, viaducts, all types	5,390,745	3.27	1.14
Subways, overhead crossings, etc.	603,330	.36	.13
Culverts	1,194,574	.72	.25
Watermains and connections	6,144,804	3.73	1.30
Sewers and connections	3,448,486	2.09	.73
Storm sewers	1,333,236	.81	.28
Tile drains, drainage ditches and open sewers	909,160	.55	.19
Dams and reservoirs	3,637,190	2.21	.77
Fencing (excluding temporary snow fencing)	823,448	.49	.17
Guard rails	333,665	.20	.07
Signs	288,750	.17	.06
Zone painting	211,176	.13	.04
Electric stations, power plants, etc.	21,981,477	13.34	4.64
Transmission lines and towers	11,415,670	6.92	2.41
Installation of boilers and machinery	805,369	.49	.17
Railway (steam) construction work	1,445,342	.90	.31
Aerdromes or landing fields	27,906,743	16.93	5.89
Park systems (including grounds and walks)	2,146,564	1.30	.45
Underground conduits	424,977	.26	.09
Telephone and telegraph lines	320,362	.20	.07
Gas mains and connections	221,990	.14	.04
Docks, wharves, piers and breakwaters	3,773,867	2.29	.80
Retaining walls, embankments and rip-rapping	1,032,204	.62	.22
Canals and waterways	317,948	.19	.06
Dredging	1,044,462	.64	.22
Pile driving	235,877	.14	.04
Other engineering construction	8,624,889	5.23	1.82
Total	164,831,545	100.00	34.77

(1) Table compiled from statistics contained in the "Report on the Construction Industry in Canada 1940", p. 9.

TABLE VII

COMPOSITION OF TRADE CONSTRUCTION ACCORDING TO EIGHT MAIN BRANCHES[1]

1934 - 1940

Year	Electrical Work	Plumbing, Heating and Air Conditioning	Brick, Masonry and Concrete	Carpentry	Painting, Decorating and Glazing	Lathing, Plastering and Stucco	Roofing Work	Other Trade Construction	Total Trade Construction (Jobbing)
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1934	1,905,562	7,281,375	2,035,994	1,211,428	2,908,009	271,262	1,849,446	5,290,165	22,753,241
1935	2,239,733	9,103,277	2,783,667	1,149,944	3,691,904	491,475	2,680,627	4,709,959	26,850,586
1936	4,367,579	14,134,889	2,326,852	1,576,016	5,031,050	1,018,783	4,619,082	6,407,258	39,481,509
1937	5,224,308	16,977,428	2,175,082	1,450,444	5,543,755	1,265,301	6,079,193	9,300,255	48,015,766
1938	5,359,723	16,619,462	2,168,163	1,862,973	5,721,462	1,205,389	5,952,144	7,653,649	46,542,965
1939	4,568,876	15,899,175	2,102,490	1,953,966	6,071,890	993,089	5,626,526	8,643,649	45,859,661
1940	5,036,352	17,712,940	2,095,012	2,498,457	6,892,340	1,187,082	6,658,978	9,409,512	51,490,673

(1) Table compiled from "Report on the Construction Industry in Canada, 1940", p.5.

TABLE XIII

BREAKDOWN OF TRADE CONSTRUCTION 1940 (1).

Type of Trade Construction	Dollars	Percent of Trade Construction	Percent of Total Construction
Air conditioning	729,723	1.42	.15
Bricklaying	943,005	1.83	.20
Carpentry work	2,498,457	4.85	.53
Commercial refrigeration	594,584	1.16	.13
Concreting and cement work	956,033	1.86	.20
Electrical work	5,036,352	9.78	1.06
Elevators, service	2,033,583	3.95	.43
Excavating	1,857,234	3.61	.39
Flooring	442,111	.86	.09
Glass and glazing	960,086	1.86	.20
Lathing, plastering and stucco	1,187,082	2.30	.25
Masonry and stone work	195,974	.38	.04
Ornamental iron work	260,090	.51	.06
Painting and decorating	5,932,254	11.52	1.25
Plumbing, heating and sanitary engineering	16,983,217	33.00	3.58
Roofing, sheet metal	1,156,755	2.24	.24
Roofing, all other	2,738,856	5.32	.58
Sheet metal work, other than roofing	2,763,367	5.36	.58
Sprinkler installation	568,718	1.11	.12
Structural steel work	1,595,127	3.09	.34
Tiling, marble and terrazzo	666,973	1.30	.14
Weatherstripping and insulation	1,035,368	2.00	.22
Wrecking and demolition	215,496	.42	.05
Other trade construction	140,228	.27	.03
Total	51,490,673	100.00	10.86

(1) Table compiled from statistics contained in the "Report on the Construction Industry in Canada 1940", pp. 9-10.

NEW CONSTRUCTION AND ALTERATIONS AND REPAIRS[1]

1934 - 1940

Year	New Construction		Alterations and Repairs		Total	
	Dollars	Percent	Dollars	Percent	Dollars	Percent
1934	115,988,781	62.29	70,210,109	37.71	186,198,890	100
1935	140,988,228	65.41	74,560,645	34.59	215,548,873	100
1936	170,645,824	66.12	87,394,576	33.88	258,040,400	100
1937	244,946,916	69.61	106,927,198	30.39	351,874,114	100
1938	240,549,164	68.12	112,674,121	31.88	353,223,285	100
1939	258,662,409	69.31	114,541,271	30.69	373,203,680	100
1940	352,301,695	74.31	121,821,083	25.69	474,122,778	100

(1) Data taken from "Report on the Construction Industry in Canada, 1940", published by the Dominion Bureau of Statistics, p.5.

TABLE XV

GROSS VALUE OF CONSTRUCTION PERFORMED BY GENERAL AND TRADE CONTRACTORS, DOMINION GOVERNMENT, HARBOURS BOARD, PROVINCIAL GOVERNMENTS AND MUNICIPALITIES - DOLLAR VALUES(1).

1934 - 1940

Year	Construction Work by General, Trade and Sub-contractors Dollars	Construction Work undertaken directly by the Dominion Government Dollars	Construction Work undertaken directly by the Harbours Board Dollars	Construction Work undertaken directly by Provincial Governments Dollars	Construction Work undertaken directly by Municipalities Dollars	Total Construction Work Dollars
1934	99,381,822	19,332,023	3,255,940	35,252,884	28,976,221	186,198,890
1935	147,530,111	14,384,512	1,966,576	32,032,120	19,635,554	215,548,873
1936	196,737,443	8,767,819	1,983,044	31,914,208	18,637,886	258,040,400
1937	278,209,051	6,484,465	1,616,949	45,435,326	20,128,323	351,874,114
1938	281,484,690	9,256,809	1,481,456	38,136,854	22,863,476	353,223,285
1939	286,712,459	15,109,951	1,407,686	46,249,892	23,723,692	373,203,680
1940	379,654,887	37,725,635	1,263,090	35,860,979	19,618,187	474,122,778

(1) Data taken from "Report on the Construction Industry" 1934 - 1940, published by the Dominion Bureau of Statistics.

GROSS VALUE OF CONSTRUCTION PERFORMED BY GENERAL AND TRADE CONTRACTORS, DOMINION GOVERNMENT, HARBOURS BOARD, PROVINCIAL GOVERNMENTS AND MUNICIPALITIES - PERCENTAGES(1).

1934 - 1940

Year	Construction Work by General, Trade and Sub-contractors Percent	Construction Work undertaken directly by the Dominion Government Percent	Construction Work undertaken directly by the Harbours Board Percent	Construction Work undertaken directly by Provincial Governments Percent	Construction Work undertaken directly by Municipalities Percent	Total Construction Work Percent
1934	53.33	10.37	1.77	18.96	15.57	100.00
1935	68.44	6.68	.93	14.85	9.10	100.00
1936	76.24	3.41	.78	12.36	7.21	100.00
1937	79.08	1.85	.45	12.91	5.71	100.00
1938	79.69	2.63	.42	10.78	6.48	100.00
1939	76.83	4.05	.38	12.39	6.35	100.00
1940	80.08	7.95	.27	7.57	4.13	100.00

(1) Calculations based on the statistics contained in previous table.

TABLE XVII.

BREAKDOWN OF A CONDUITS CONSTRUCTION JOB IN MONTREAL IN 1936-1937(1)

	Man-days	Average Rate	Construction Costs Dollars	Construction Costs Dollars
Common Labour	9,744	8 hrs. @ $ .35	27,283.20	
Skilled and semi-skilled	1,004	8 " @ .50	4,016.00	
1 compressor man, 2 truck drivers	593	8 " @ 1.00	4,744.00	36,043.20
Commission staff on job: engineers, inspectors, sketchman	811		5,750.10	
Commission staff in office: engineers, draftsmen, records	636		4,249.90	
Commission overhead expenses			4,257.13	14,257.13
Repaving of sidewalks and road surface by the City of Montreal (Road Department) 60 percent labour ($4.00 per man-day)	3,459			13,836.36
				64,136.69
Materials used on job (see following Table)				66,430.32
Financial charges to April, 1939				130,567.01
				9,638.48
Companies' Inspectors Time: Municipal Light, Heat and Power Department, Gas Department, City Sewer and Water Department	350			
TOTAL	16,597			140,205.49

SECONDARY EFFECTS OF CONDUITS CONSTRUCTION(2)

Removing of poles, wires, etc.	
Re-wiring of 409 buildings for new underground service	232 Poles 409 Services
Installation of street light, police, fire and traffic standards	102 Standards
Installation of cables	113,437 Feet

(1) Data supplied by the Electric Commission of the city of Montreal. The construction job undertaken by the firm of contractors lasted from October 2, 1936 to January 15, 1937, and from April 29, 1937 to October 9, 1937. It took about 3 years to remove the poles, overhead wires, to re-wire 409 buildings for new underground service, to install street lights, police, fire and traffic signals and to install the cables necessary. Work on the plans for this construction job started on November 16, 1935 and was completed on July 1, 1938. Rentals started on July 1, 1938.

(2) For estimates of secondary effects of conduits construction, see text.

TABLE XVIII.

BREAKDOWN OF MATERIALS USED ON A CONDUITS CONSTRUCTION JOB IN MONTREAL, 1936-1937(1)

Type of Material	Unit	Cost per Unit Dollars	Total Costs Dollars
Fiber ducts	279,413 Feet	.11	30,735.43
" bends	957	2.39	2,287.23
Cement	15,610 Bags	.58	9,053.80
Sand	1,499 Tons	1.35	2,023.65
Stone 1/2" & 3/4"	2,986 "	1.15	3,433.90
Stone dust	500 "	.90	450.00
Cast Iron M.H. Frame & Cover Machined 125 x 530 pounds	66,250 Pounds	.55	3,643.75
Cast Iron 6" P.Trap (50 x 56 pounds = 2,800 pounds)	50	2.50	125.00
Cast Iron Grate A (75 x 16.5 = 1,238 pounds)	75	1.10	82.50
Cast Iron Grate B (50 x 11 = 550 pounds)	50	1.75	87.50
Cast Iron Trans Frame (6 x 304) 24.5 x 12 =)	4,800 Pounds	.055	264.00
Galvanized Iron 3½" Pipe (Laterals)	940 Feet	.70	658.00
Galvanized Iron 2" x 2" Angle Iron (Cable Racks)	3,214 "	.22	707.08
Galvanized Iron 3/4" Iron (Pulling Iron)	478 "	.25	119.50
Steel Transformer Cover (3 x 6 = 18)	3,870 Pounds	.135	522.45
Steel 6" I Beam @ 17.25 pounds	2,717 "	.04	108.68
5/8" Reinforcing	17,321 "	.03	519.63
Sewer Tile 6" (50 M.H. @ 25 feet)	810 Feet	.44	356.40
Street light foundations bolts	416	.50	208.00
Cable racks bolts	4,290	.10	429.00
4/c Copper Wire	1,000	.20	200.00
Laterals strap	190	.21	39.90
Lag screws 1/2"x4"	400	.04	16.00
Ground Clamp	10	1.29	12.90
Solder	30 Pounds	.46	13.80
Ground Hooks	200	.04	8.00
Jakum	300 Pounds	.08	24.00
Lumber	15,000 Ft.B.M.	40.00	600.00
Nails	215 Pounds	.04	8.60
			56,738.70
Miscellaneous materials used on job			567.39
Material used by City of Montreal for Repaving Sidewalks and Road Surface 40 percent Material			9,124.23
	TOTAL		66,430.32

(1) Data supplied by the Electric Commission in Montreal. Project was carried out in District No. 28.

TABLE XX

GROSS VALUE OF CONSTRUCTION BY PROVINCES - DOLLAR VALUES (1)

1934 - 1940

Year	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Canada
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1934	304,556	9,870,626	6,165,142	42,862,777	96,458,580	6,343,085	6,905,495	7,532,434	9,756,195	186,198,890
1935	1,190,030	15,657,298	9,988,340	58,309,829	90,848,941	10,473,633	5,061,354	10,183,322	13,836,126	215,548,873
1936	816,141	15,434,295	11,982,253	67,902,087	108,260,433	12,929,022	8,314,668	9,611,860	22,789,641	258,040,400
1937	754,448	20,180,404	17,557,146	101,460,731	148,352,327	12,475,326	8,436,495	11,198,894	31,458,343	351,874,114
1938	1,331,442	18,038,687	14,974,820	100,830,603	151,435,842	14,247,661	11,020,224	13,166,662	28,177,344	353,223,285
1939	1,948,064	19,890,449	14,886,121	118,529,680	144,829,394	14,848,706	13,429,064	17,856,669	26,985,533	373,203,680
1940	4,147,583	28,637,404	13,002,828	127,438,996	192,304,380	25,232,785	21,243,412	27,350,018	34,765,372	474,122,778

(1) Table compiled from statistics contained in "Reports on the Construction Industry" 1934-1940, published by the Dominion Bureau of Statistics.

TABLE XXI

GROSS VALUE OF CONSTRUCTION BY PROVINCES - PERCENTAGES(1)

1934 - 1940

Year	Prince Edward Island Percent	Nova Scotia Percent	New Brunswick Percent	Quebec Percent	Ontario Percent	Manitoba Percent	Saskatchewan Percent	Alberta Percent	British Columbia Percent	Canada Percent
1934	.16	5.30	3.31	23.03	51.80	3.41	3.71	4.04	5.24	100
1935	.55	7.26	4.63	27.06	42.15	4.86	2.35	4.72	6.42	100
1936	.32	5.98	4.65	26.31	41.95	5.01	3.22	3.73	8.83	100
1937	.22	5.74	5.00	28.83	42.17	3.54	2.59	3.18	8.93	100
1938	.38	5.11	4.24	25.55	42.87	4.03	3.12	3.73	7.97	100
1939	.52	5.33	3.99	31.77	38.81	3.98	3.59	4.78	7.23	100
1940	.88	6.04	2.74	26.88	40.56	5.32	4.48	5.77	7.33	100

(1) For sources of statistics, see previous Table.

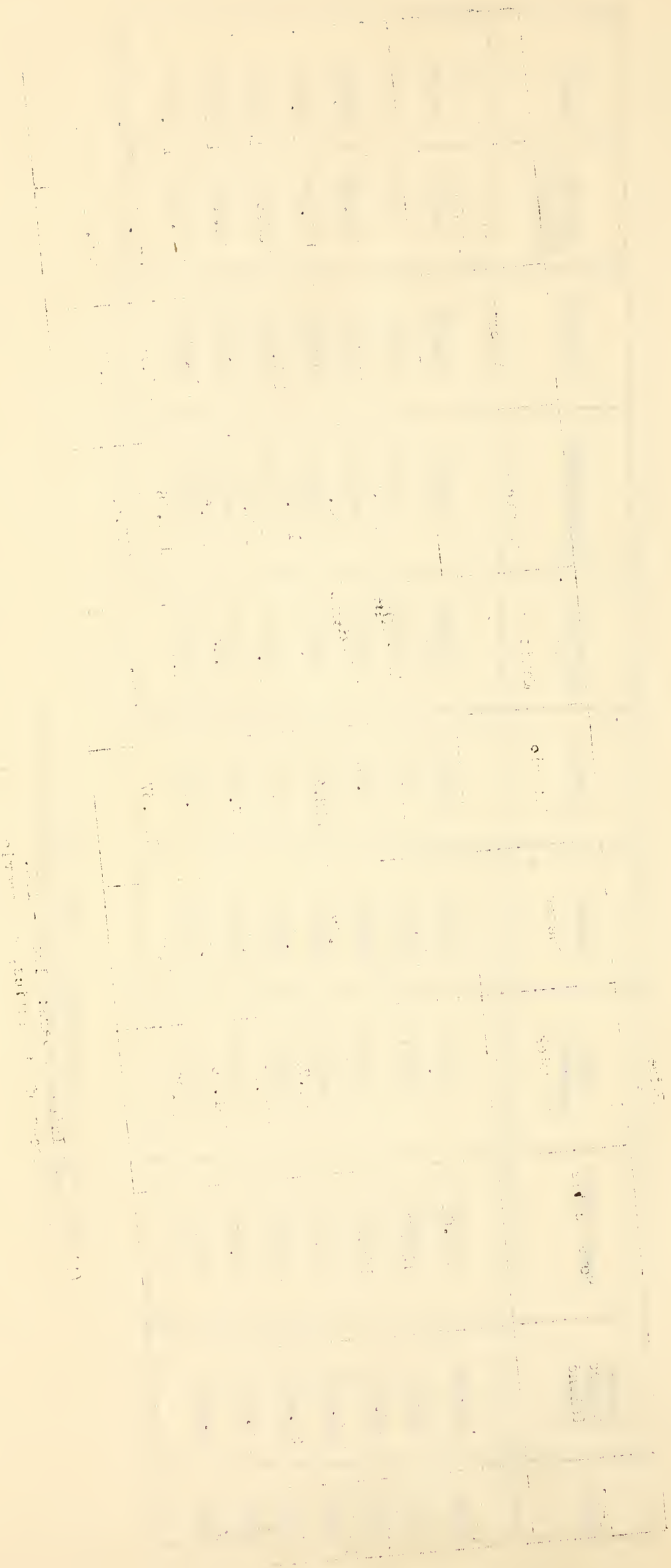
TABLE XXII

TREND OF CONSTRUCTION BY PROVINCES - INDEX NUMBERS(1)

1934 - 1940.

Year	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Canada
1934	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1935	390.01	158.61	162.01	136.04	94.18	165.13	73.29	135.20	141.89	115.78
1936	267.54	156.36	194.36	158.42	112.23	203.83	120.43	127.62	233.60	138.45
1937	247.20	204.44	284.79	236.71	153.80	196.52	122.20	148.69	322.45	182.55
1938	436.40	182.74	242.90	235.24	157.00	224.63	159.58	174.81	288.82	188.51
1939	638.70	201.50	241.46	276.53	150.15	234.10	194.46	237.10	276.61	200.43
1940	1360.00	290.11	210.90	297.32	199.37	397.81	307.60	363.12	356.34	254.62

(1) Base of Index Numbers: 1934 - 100.
For sources of statistics, see previous Table.



ADVISORY COMMITTEE ON RECONSTRUCTION

THE ORGANIZATION OF THE CONSTRUCTION INDUSTRY AND THE CONSTRUCTION LABOUR FORCE

Preliminary Report III.

on

The Construction Industry in Relation to Post-War Economic Policy

by

O.J. Firestone, Ph.D.

Ottawa May 1943

P.R. 14005.

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SYNOPSIS

There are two ways in looking at the role which the construction industry plays in the Canadian economy: one is looking at its accomplishments, the other is viewing its short-comings.

In spite of the fine contribution and achievements of a number of contractors and builders, it must be said that the construction industry is very much behind in its development if compared with other industries.

The strength of the industry and its working force, its organization and possibilities for improvement can be briefly summarized as follows:

Contractors and Builders

1. The construction industry proper is composed of (a) general contractors who are firms or individuals carrying out construction work for owners in accordance with instructions received; (b) trade contractors (also termed jobbing builders or small master builders) who are usually engaged in repair work, remodelling, painting and decorating, (c) operative or speculative builders who construct residential buildings on their own account for the purpose of selling during the period of construction or after completion; and (d) sub-contractors who undertake certain sections of work on construction projects for general contractors or operative builders.

2. On an average, there are between ten and twelve thousand contracting and building firms in operation in Canada. In prosperous years their number exceeds the first figure, in years of depression it declines below the second. Firms with fifteen or more employees give work to 80 - 90 per cent of all wage-earners in the construction industry.

3. Scarcely any other group has contributed such a large proportion of its members to the armed forces as contractors and builders have done. According to a 58-percent sample survey of men enlisted in the armed forces, there were 2,293 contractors and builders reported enlisted in August 1942. Of that group 94 per cent claim that they had been working before enlistment and only 6 per cent had been without work. Contractors and builders are more optimistic about post-war conditions in Canada than other professions. This can be seen from the comparatively high proportion of those contractors and builders, namely 52 per cent, who claim to have made arrangements which they believe will enable them to make a satisfactory livelihood after the war. The remaining 48 per cent have made no provisions and some of these men will depend on government rehabilitation schemes.

4. The irresponsible element in the construction industry, particularly a section of speculative builders has done great harm to the good repute of the construction industry. Quite a number of speculative builders are not guided by principles of fairness towards labour and customers. They cut wages and try to sell sub-standard houses at the highest possible prices. This type of builder is very seldom burdened by business ethics, and bankruptcy is no hindrance for continuing the speculative building business. It may be impossible to eliminate completely the irresponsible element in the entrepreneurial field of construction; but certain safeguards protecting contractors and builders of repute, construction workers and the public as a whole are badly needed.

5. A possible answer is licensing of contractors. Under such a licensing system certain minimum requirements as to experience, financial standing and integrity would have to be fulfilled by anybody desirous of setting himself

up in the contracting and building business. Building by-laws, building inspection, lien and bankruptcy acts have proved no protection against the practices of irresponsible builders. Other safeguards are required, particularly in the post-war period, when building and construction will experience great expansion. A licensing system would also provide the governments concerned with an efficient tool to restrict the entry of newcomers into the construction field in short boom periods. In the majority of cases these newcomers fail, go bankrupt and withdraw shortly after a decline occurs in the volume of construction. Thus, licensing could be used for the purpose of protecting would-be contractors and builders from their own lack of foresight.

6. Residential construction is marked by the absence of large building concerns, which engage in practically all other fields of construction activity. If large contracting firms would realize that an enormous market in the field of low-cost housing will exist in the post-war period, they might be induced to enter the field of residential construction. Efficient business methods, adequate financial resources, adequate knowledge of sound planning and layout and a measure of selling ingenuity are essential requirements for any firm intending to enter the house building field on a large scale.

Organization of the Construction Industry

7. Compared with other industries, entrepreneurs in the construction field are not well organized. This is indicated by the great number of small associations scattered all over the country. In 1937, there were 245 members per association in the mining industry, 135 in the manufacturing industry, 126 in the transportation and communication industry and only 52 in the building and construction industry. (1)

8. The biggest organized group in the construction field is the Canadian Construction Association and affiliated organizations. Over 1100 general and trade contractors are members, either directly or through affiliated associations. The Canadian Construction Association claims that between 50 to 60 per cent of the total contract-construction in Canada is carried out by members of the Association.

9. There are a number of other organizations in the field of trade construction, such as painting and decorating, plumbing, electrical contracting business, etc. With the exception of the Canadian Institute of Plumbing and Heating, which represents an active and modern-thinking group, these organizations are small and of little practical importance.

10. With the exception of the Home Builders' Associations in Toronto and Vancouver, the field of residential construction is practically unorganized. The overwhelming strength of speculative builders in the house building field has made organization of firms engaged in residential construction impossible. A central organization in the construction industry is needed, particularly in the housing field, not only to co-ordinate the interests of contractors and builders and preparing adequate plans for the post-war period but also to give medium and small builders an opportunity to make a contribution to the industry by a co-operative pooling of their resources. A step in this direction is evident in the recent venture of a small group of house builders who formed the "National House Builders' Association." This organization aims at (a) an association of home builders for the purpose of mutual advantage and co-operation, (b) improvement in the quality and character of houses, (c) development and establishment of standards of practice in the house building field, (d) exchange of experience and information, and (e) representation of its members in matters of national, provincial and local policy affecting house building.

---

(1) There has been no radical changes either in the form of organization or in the number of members of organized building industry in recent years.

11. The National Construction Council, founded in 1933, includes representatives of management and labour. The objectives of this Council were drawn up with great foresight. They include: (a) the task of unifying the construction industry, planning its future and formulating its aspirations as an industrial unit, (b) a study of ways and means of stabilizing the industry and eliminating waste, (c) the promotion of fair professional ethics and business practices, and (d) the co-ordination of industrial and scientific research in the construction field, including manufacturers of building materials, builders and contractors. It is regrettable that, in spite of its commendable aims, the National Construction Council has not been able to make a serious attack on the problems which the construction industry in this country faces. The National Construction Council or another organization may possibly become the nucleus of a central organization representing the construction industry in Canada in the post-war period. In any case, the need for such an organization to look after and further interests of the industry for the sake of the public as a whole is beyond question.

Organized Construction Workers.

12. Construction workers are better organized than their employers. In 1941, construction workers formed the third largest group, exceeded in strength only by the railroad transportation workers and metal workers. In spite of this fact, in 1941 only about 22 per cent of the total number of wage earners (skilled, semi-skilled and unskilled) in the industry were organized. This proportion is distinct from those given in (14), which refers to construction craftsmen only.

13. In 1941, 57 per cent of organized construction workers were members of the Canadian Trades and Labour Congress, 23 per cent were members of the Confederation of Catholic Workers, 12.1 per cent members of independent unions, 7.6 per cent members of the Canadian Congress of Labour and 0.3 per cent members of the Canadian Federation of Labour.

14. Organization of construction workers has made great progress since the beginning of the century, especially since the outbreak of the present war. However, as the following figures indicate, the majority of skilled construction workers are not yet organized: (a) organized construction craftsmen form only 18 per cent of the total number, (b) organized construction craftsmen comprise 36 per cent of craftsmen working in the construction industry; and (c) organized construction craftsmen represent only 44 per cent of wage-earner craftsmen working in the construction industry.

Standardization Applied to the Building Industry

15. Standardization is defined as a set-up by authority, custom or general consent of rules or models by which extent, quantity, quality, value, performance and service may be gauged. After the conclusion of the last war, national standardizing bodies were functioning in twenty-seven countries including the British Empire, the United States, most European countries, U.S.S.R. and Japan.

16. The advantages of standardization may be summarized as follows: (a) it stabilizes production and employment, (b) it reduces selling cost, (c) it promotes fairness in competition by putting tenders on a comparable basis, (d) it makes mass production possible, (e) it creates better quality commodities permitting business efficiency and research work to concentrate on a comparatively small variety of the same commodity, (f) it helps to eliminate practices which impede development, particularly important for the building industry, (g) the interchangeability of parts makes replacement in service to customers considerably easier than is the case when no standardized parts are used; thus it works as a stimulous to domestic and foreign trade, (h) standardization within and between industries leads to better understanding among industries.

17. Standardization should not be identified with simplification. The latter term means the commercial elimination of unnecessary variety in sizes, dimensions, grades or qualities of common commodities. Simplification removes waste due to over-diversification of commodities but it does not call for re-development, an important factor in standardization. Simplification may clear the way for standardization, and standardization frequently results in simplification but the objectives are quite different and should not be confused.

18. There are four main types of standardization in the building field: (a) standardized building design, (b) standardization of dimensions, (c) standardization of quality, and (d) standardization of assembly.

19. Most laymen object to standardized building design because they think in terms of a great number of block of identical houses with only the street numbers to distinguish one dwelling from another. This is, however, not the true meaning of standardized building design. Every building design employs a number of repetitive elements: the door, the window, the arch, the stair. Efficient building design means only a combination of elementary design standards, old standard elements often being discarded, new ones developed. These elements are combined in different ways to meet different needs but nevertheless repeating those combinations which have proved their value. In fact, it is only through repetition that the work of a particular architect acquires recognizable style. Schools of architectural designs develop only because of the repetitive use of certain elements by a group of designers.

20. Efforts towards dimensional co-ordination of building materials have been particularly strong in the United States in recent years. These efforts are based on the "modular" system which advocates the use of multiples of 4 inches or 4 feet in all dimensions. A Committee, known as Project A62, sponsored jointly by the American Institute of Architects and the Producers Council Incorporated has been investigating for over three years the advantages of a modular system in the building field. It has recommended its adoption to the American Standards Association and has pointed out the great advantage inherent in dimensional co-ordination of building materials and equipment.

21. Standardization in quality of building materials has made considerable progress in the United States particularly in recent years. A great number of building materials are sold on a certified guarantee basis. In Canada, very little has been done to standardize and simplify the quality of building materials. This is one of the great handicaps in reducing building costs, standard quality of building materials being one of the elementary requirements of the low-cost house.

22. Standardization of assembly is a method which makes possible a more economical construction of projects by the use of standardized parts. One American firm, the Homasote Company of Trenton, New Jersey, has carried standardization of assembly much further than any other firm in this country or the United States by putting the modular system to practical use. In that way it has reduced constructions costs considerably.

23. Standardization is carried on in the United States by private agencies and the government. The most outstanding private organization is the American Standards Association which is a co-ordinating agency for the purpose of bringing about systematic participation by and co-operation of the many organizations and associations working on problems of standardization. A number of government departments are interested in standardization but standardization has been made the particular concern of one central agency, the National Bureau of Standards, working under the Department of Commerce. This Bureau is concerned with research, testing and commercial standards. With regard to the latter, its service is mainly promotional in character and based on voluntary standards. It has proved an important co-ordinating body; its work is complimentary to that of the American Standards Association. Since the volume of construction carried on in the United States is considerable (between 3 to 12 billion dollars annually) the work of the National Bureau of Standards in this field has resulted in appreciable savings by the construction industry, and ultimately the consumers.

24. In Canada organized work on standardization has been carried out by the Canadian Engineering Standards Association, established in 1919. This agency included among its members representatives from the Canadian universities, professional bodies, industrial associations, government departments, public utilities, the Canadian Electrical Association and the Canadian Manufacturers Association. The C.E.S.A. has done commendable work on standardization and simplification in certain fields such as civil, mechanical and electrical engineering, automotive and railway work, ferrous metals, steel constructions and air-raid precautions. However, practically no work has been done in the field of building and construction materials. The reason is: the activity of the C.E.S.A. depends on the initiative taken by the industries concerned. Progressive industries like the heavy steel industries or manufacturers of electrical appliances have taken the initiative and benefitted considerably by the introduction of standards. Other more backward industries, such as the construction industry, have not done much research in building materials and processes and, therefore, very little has been done to standardize or simplify materials in spite of the urgent need for it. The secretary of the C.E.S.A. pointed out recently that the "industry has the option of directing development in the field of standardization or the alternative of having it placed under government control".

25. At least six Dominion Government departments are interested in problems of standardization but there is no central agency of the type of the National Bureau of Standards in the United States. The construction industry has done nothing in the past twenty years to further standardization and simplification of materials and processes which are essential factors in determining the cost and the quality of its products. Furthermore, standardization and simplification are essential requirements for a well planned post-war housing policy. If a Dominion Bureau of Standards were created, charged primarily with the initiative, co-ordination and research in the field of standardization and simplification of building materials and processes, it could be of the greatest value to the construction industry. If so desired, it could gradually include other fields of industrial standardization. The task of the Bureau would be complimentary to the activity of the C.E.S.A.; primarily its work would be to co-ordinate the standardization work of existing government agencies and to take the initiative in fields where private industry has failed to step in, either because of its lethargy or because it did not consider such enterprise profitable.

Integration of the Construction Industry

26. Integration of the construction industry means the organization of the construction industry and related industries on such a basis as to make certain that the relations between the essential stages of production and consumption follow a simple, clearly defined line. Such organization results in minimum waste caused by the overhead of exchange, and permits each step to be carried out at a maximum efficiency. The need for the integration of the construction industry has been emphasized by a number of men of repute in Canada and in other countries. Among them is Mr. Alvin H. Hansen, who calls the construction industry the most backward industry in the United States, and Dr. W.C. Clark, who has asserted that the house building industry in particular must either introduce a greater measure of organization, efficiency and standardization, or it must be content to see the industry securing a steadily decreasing share of the consumer's dollar and suffering as a consequence from continuing stagnation, chaotic conditions, public illwill and, possibly, increasing interference from public bodies.

27. The following enterprises contribute their share to the completion and maintenance of a satisfactory building product: (a) Industries producing raw material required for building and construction: (b) industries which fabricate the raw material into equipment, parts and building material; (c) the transportation industry which brings the raw material to the factories and the equipment, parts and other building materials to the site; (d) the professional men like architects, engineers, etc., who prepare the plans for construction projects; (e) the contractors who undertake the assembly of materials and workers required for the purpose of completing a construction project; (f) wholesale and retail business with

its hierarchy of sales agencies which distribute the equipment, parts and other building material required from the factory to the consumer or his representative, the contractor; (g) the financial institutions which provide the funds required to bridge the gap between raw material production and the ultimate consumer; and (h) construction tradesmen who keep buildings in serviceable condition.

28. Up to the present time, only the firms producing raw material and fabricating parts have reached a comparatively advanced stage of organization. The construction industry proper, however, offers a sad picture of disorganization and backwardness. Manufacturers of material, contractors, speculative builders, architects, realtors and consumers, are isolated units with cross connections in every conceivable direction. So many alternative paths for the flow of goods and services results inevitably in duplication of effort. As a matter of fact, a completed house consisting of many thousands of parts is built virtually at retail prices. The duplication of effort and the absence of standardized parts--where standardization does not affect individual idiosyncrasies--is one of the major causes of high construction costs.

29. Little has been done hitherto to assure liquidation of obsolete and unsanitary housing units. Education of the public and legal and administrative provisions to assure their liquidation are essential requirements for the post-war period. Such measures would not only assure a continuous market for new construction but also be an important contribution to safeguarding the nation's health.

30. Two suggestions have been brought forward on which a study of the problems of integration of the construction industry can be based. (a) One recommends that integration be carried out in steps from the manufacturers of raw material and parts, sub-assembly firms (manufacturers of wall; floor and roof panels, plumbing units, etc.) to those engaged in design operations. (b) The second suggestion recommends the co-ordinated effort of pre-fabricators and large-scale operative builders. The key factor in this picture is the large-scale developer who co-ordinates the functions of final assembly, (including site development and community planning), distribution (including long-term financing), servicing throughout the useful life of the community, and finally liquidation, that is, by one means or another assuring that existing, worn-out units are taken out of occupancy in proportion to new construction.

Recommendations.

31. Methods of integrating the construction industry are being studied with great interest in Great Britain and the United States. Little has been done in Canada as yet. The success of a large-scale construction programme in the post-war period, especially in the residential field, will, to a great extent, depend on more efficient methods of building and an improved organization of the industry. Unless the industry pulls out of its present lethargy and works out plans which will enable it to provide satisfactory products at the proper price, it will not be able to meet the building requirements of the post-war period just as it has been unable to meet the requirements for low-cost housing in the pre-war period.

The Dominion government could encourage and further development in the construction industry by undertaking a number of measures which are described in detail in Section V. The main theme of these measures is that the government should not only encourage the construction industry to prepare plans for the purpose of meeting the demands involved in a large-scale post-war construction programme, but at the same time, should lay the foundation for research, standardization, experimental building (low-cost housing) and other spheres of building activity which have scarcely been touched by private industry.

I. CONTRACTORS AND BUILDERS

Entrepreneurs in the construction industry can be divided into the following four main groups (1):

(a) General Contractor: Firms or individuals who carry out construction work for prospective owners in accordance with instructions received are called "contractors." They are legally responsible for the execution of the construction project undertaken. These firms do part of the actual construction--very often the major part--with their own staff and equipment. The remaining part of the work is farmed out to small and specialized firms, termed "sub-contractors." Thus, general contractors are not only concerned with the supervision of their own staff and the execution of the work undertaken but also with the coordination of the work sublet to numerous sub-contractors.

There are large and small general contracting firms. The former are particularly concerned with large industrial, commercial, public and semi-public construction projects, for example, a factory, a warehouse, a school, a hydro-electric plant. The small "general contractor" is distinguished from the large contracting firm mainly by the volume of construction and, in some cases, by the fact that he carries out the major proportion of his work with his own field staff, endeavouring to reduce sub-contracting to an absolute minimum. As a rule, he does not undertake speculative building though he will undertake maintenance and remodelling work.

The number of general contractors as compared with the total number of firms in the construction industry is small but they execute the major proportion of construction work undertaken in this country. They provide employment for the majority of wage earners working in the construction field.

(b) Trade Contractor: The trade contractor is also termed a "jobbing builder," "small master builder" and "master workman." He is usually engaged in repair work, remodelling, painting and decorating and rarely erects new buildings. These firms are small and their activities are usually restricted to the locality in which they are situated. In some big cities, like Montreal and Toronto, some firms of trade contractors have grown from very small enterprises to concerns doing a fairly large volume of business. These firms sometimes take also sub-contracts from general contractors. Thus, they also fall under the classification of sub-contractors. This type of firm, however, forms only a small proportion of trade contractors.

The individual firms of trade contractors vary greatly in size according to the volume of business on hand. In spite of the fact that most of the firms are small, they make up a considerable proportion of the total number of firms engaged in the construction industry.

(c) Speculative Builder: Sometimes the speculative builder is called "operative builder," "owner builder" or "developer of home sites." (2) Speculative builders construct residential buildings on their own account for the purpose of selling them during the period of construction or after completion. In some cases, speculative builders do not sell but continue to operate buildings if they find such a procedure profitable. The procedure followed by speculative builders varies.

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(1) For a discussion of the size and organization of firms in the building industry in Great Britain, see H.W. Robinson: "The Economics of Building," London, 1939, pp. 8 ff.

(a) The term "operative builder" should be substituted for "speculative builder" because the speculative element is not always a characteristic of that type of builders.

H.W. Robinson points out that speculative builders usually follow a pattern of procedure somewhat like this: A "land jobber," sometimes the speculative builder himself acquires land which he considers will be valuable for building, and lays it out for building purposes by construction streets and sewers. The speculative builder, if he considers houses are really required, then buys or leases a number of building sites, often paying only a deposit and arranging to pay the balance after selling the houses he intends to build. He then draws up plans (either doing this himself or employing an architect), paying due regard to regulations regarding number of houses per acre, size of rooms, drainage and so on, has them passed by the local authority, and commences to build. Often the speculative builder has insufficient resources to finance the whole project himself and has to borrow capital; usually he obtains a bank overdraft, but sometimes he is able to arrange a loan elsewhere. He next obtains his materials from the brickmaker, timber merchant, and builder's merchant, who protect themselves by arranging that the persons financing the builder guarantee payment of their accounts.

When the houses are erected, he either raises a mortgage on the property and pays off the loan, keeping the houses as an investment, or he sells the houses outright to investors or owner-occupiers. He may mortgage the completed houses through a lending institution for the buyers, though in some cases the buyers will arrange this independently. The builder's profit depends, obviously, on the difference between the selling price and the costs incurred. (1)

The need for distinguishing between a contractor who operates under contract for specific projects and the speculative builder who is the initiator and the builder of the projects which he undertakes, has been emphasized by Mr. A.S. Mathers, the President of the National Construction Council of Canada. According to Mr. Mathers, a contractor is bound to the type, quality and price of materials and the wage rates which he has to pay to the construction labour force. Contractors of standing lay great emphasis on friendly relations with their workers and therefore coordinate their employment policy in agreement with construction trade unions. The speculative builder, however, is subject to none of the restrictions under which a contractor operates. Working independently--the only restrictions imposed on the operative builder coming from lending institutions--a certain section of speculative builders is less concerned with the quality of the project and friendly labour relations than with producing houses which they are likely to sell at great profits.

Distinction should be made between two types of speculative builders. One group are men of repute, familiar with the building field, who consider it an asset to build up the reputation of their firms and desire to sell to the public good quality houses.

However, the operative building business has been ruined by a group of speculative builders who are out to make as large profits as possible by supplying the public with unsatisfactory housing far above the cost price. This type of speculative builder is not always expert in the building field. He is often a more or less successful real estate or business man who has been able to obtain the necessary means of financing house-building developments. He pays a wage lower than trade union rates, works his men hours longer than those set by the provisions of the Industrial Standards Acts. He is often a hardened business man who has no fear of bankruptcy and, if he goes bankrupt, succeeds in carrying on his activity under a different name. He represents the less desirable element in the construction industry and has contributed to the lowering of the repute of the construction industry as a whole.

Mr. Mathers takes a strong stand against speculative builders as a group. He does not distinguish between the responsible and irresponsible elements in this group but believes speculative builders have done very little to provide the public with satisfactory housing. According to Mr. Mathers, speculative builders try to avoid employing organized labour and pay to their workers lower

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(1) Ibid., pp. 9 - 10.

wage rates than those prescribed by the trade unions. This practice is resented by the unions. Hitherto, however, attempts to organize the speculative builders' labour supply have not met any notable success. One of the main reasons is the so-called system of "labour contract." Under this system, a group of workmen contract for labour of a particular trade on a lump-sum basis, their remuneration being considerably lower than the one the workers would receive if work was paid for on an hourly wage schedule. By working longer hours, including Saturdays and holidays, workers under "labour contract" are able to obtain a higher monthly income than they would if employed on an hourly wage rate basis. This practice is prohibited by Industrial Standards Acts. Nevertheless, Mr. Mathers reports "that such practice is common in the Province of Ontario (see Appendix I).

Mr. Mathers' objection against speculative builders are justified if they are related only to a certain section of this group of builders. Other authorities on the subject maintain that a builder cannot be condemned outright just because he is a speculative builder. Some men in the field have done a commendable service. It is admitted, however, that the residential building field has been ruined by a considerable element of irresponsible builders who have undermined the public's confidence in the reliability of the house-building industry. Due to the influence of unreliable elements in the residential construction field, it has become a well known fact, in the words of Mr. Mathers, that in many cases "the prospective house purchaser and indeed the tenant as well, has no opportunity of obtaining well designed, well built or modern housing. He must be content with the jerry built construction conforming to the ludicrous design concepts of the average speculative builder."

(d) Sub-Contractor: A sub-contractor is a person who takes on a certain section of work on a construction project for a general contractor or operative builder. These firms are usually very small, employing only a few men or none at all. In a number of cases the business is conducted by the head of the family and his dependents.

Sub-contractors do all kinds of work varying from demolition and excavating work to small plumbing and electrical jobs. The reason why a considerable proportion of this type of work is sublet to sub-contractors is found in the fact that it requires specialized skill or knowledge. The volume of business contracted by sub-contractors is small but their numbers are great.

It is evident from this brief description of building firms, as H.W. Robinson and a number of other authorities have pointed out, that the building industry consists on the whole of a large number of small but highly specialized firms all competing with each other for construction work.

With the exception of a marginal group of speculative builders, the construction industry in Canada has rendered the community valuable service in difficult times. This service has been rendered in spite of the fact that since the conclusion of the last war the industry has lagged behind all other industries in its development. It is astounding what the construction industry has been able to accomplish during the present war in spite of shortages in every field of its activity. There was a dire shortage of skilled mechanics and semi-skilled and unskilled workers. It was impossible to obtain the required quantities of materials and modern machinery. With all these difficulties, the construction industry has succeeded in providing Canada with most of the structures required for industrial expansion and national defence during the present emergency.

This accomplishment proves that the construction industry possesses able and efficient men who should be in the position to cope with the still greater responsibilities which will rest upon the industry in the immediate post-war period. These men should be spurred to prepare plans to meet the contingencies of an expanded construction activity in the immediate post-war period.

It should be made quite clear to representatives of the construction industry that it will have to serve as a "shock absorber" in the immediate post-war period, that is for two or three years after the war. The volume of construction will expand considerably above the pre-war level. It is, however, impossible to keep the construction industry geared continuously at top speed.

It must expect to return to a more normal level of activity in the years following. Care should be taken that the apparent boom in the construction industry does not make the members of the construction industry too optimistic for the future. As soon as other industries are able to absorb men, temporarily placed in the construction industry, the volume of construction will decline. The construction industry will therefore have to exercise care in planning its investment in equipment and other facilities required.

The contracting and building business have proved in the past a very unstable business. The consequence was that many have left the entrepreneurial field of construction in bad times and many new men have entered the field in prosperous times in an effort to go with the tide and profit by the expansion of this industry. Because of the lack of continuity in the entrepreneurial field of construction, this industry has not been able to make headway to the same extent as other industries have made. There exists great danger that quite a number of people will try to set themselves up as "builders or contractors" in the course of the first few post-war years when they notice that business in the construction field is good. These "newcomers", having little or no experience in coping with the intricate problems of the contracting and building business, will tend to lower the standard of the construction industry, will compete on the market for the limited supply of skilled labour, will underbid the contractor of repute, and then possibly go bankrupt. In short, there is a great danger of inflation in the entrepreneurial field of construction. A possible answer may be the licensing of the contracting and building business; this is discussed later on in this section.

Numerical Strength of Contractors and Builders

There are no records available which afford a cohesive picture of the total number of contractors and builders in this country.

Statistics available in the 1931 Census give the number of owners, managers, builders and contractors as 13,012. This figure, however, does not indicate the number of firms, because very often two, three or more builders or contractors form one firm. On the other hand, there are some carpenters, bricklayers and other construction tradesmen who employ a few men and call themselves contractors. Some of these men, however, were classified under the trades to which they belong. There does not exist a generally accepted definition of the contractor. Some claim that a contractor must be a person who employs other people. This would exclude, however, small contracting firms whose members work on a partnership basis rather than on an employment basis. For example, there exists a contracting firm consisting of four brothers, all carpenters by trade, who have conducted a successful business and have built quite a number of frame houses without directly employing anybody but giving out work they cannot perform in sub-contracts. Others claim that a contractor must be a person who employs continuously three or more employees. Such a definition is not acceptable because some contractors employ a great number of men when they have work on hand and do not employ anybody when business is dull. Until a standard definition of the contractor is agreed upon, it appears to be the best solution to accept as a contractor an entrepreneur who undertakes professional construction work for other people, irrespective of the method in which he performs his functions. This means he may sublet contracts, he may have a staff of his own, or may even do the work himself with members of his family.

More recent information on the number of contractors and builders is available in the National Registration of 1940, which gives 11,539 as the strength of this occupational group. (1) From schedules received under the Unemployment Insurance Act, 1940, it was determined that in 1942 there were 5,427 firms in the building and contracting business which employed workers in performing their business. This figure, however, does not include small contractors who work on their own or sublet contracts without directly employing

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(1) Final data from the 1941 Census are not available as yet.

anybody. This figure can therefore be taken only as indicative of the total number of contracting firms of builders and contractors in this country.

According to information supplied by the Canadian Construction Association, the number of firms in the contracting and building business can be taken on a yearly average basis as between 10,000 and 12,000. In prosperous times, the number of contractors will exceed the upper figure and in a period of depression it will drop below the lower figure.

Some information is available on the number of firms in the construction field in the annual reports on the construction industry prepared by the Dominion Bureau of Statistics. Firms reported in the Construction Census include general contractors, trade contractors and sub-contractors. In some cases, branches of construction firms, operating in different towns than the head office, are included as separate units. Furthermore, under the grouping "general contractors, trade contractors and sub-contractors" are included some reports received from firms which are usually not engaged in construction but have done some construction work with their own employees, for example, erected an annex to an existing factory building. Bearing these qualifications in mind, some information on the number of contractors and employment provided by them in the construction industry will be found in Table I. This table provides also the numbers of firms with fifteen or more employees which report every month the number of their employees to the Dominion Bureau of Statistics. Annual average figures have been computed and are shown in Column E of Table I. For the purpose of comparison of annual employment, index figures are being used by the Dominion Bureau of Statistics in order to allow adjustment in the base. No such allowance has been made in the figures shown in Table I. The Employment Statistics Branch of the Dominion Bureau of Statistics indicates that on the whole firms with fifteen or more employees provide employment for 80-90 per cent of all wage earners. This rule can be taken to apply also to the construction industry. (1)

Taking into account the reservation made above referring to the crudeness of employers statistics, some rough idea can be obtained of the number of persons employed by the average contracting firm. For the period 1934 to 1941, it varied between 7 to 10 persons, the yearly average being about 8 persons (see Table II and Figure I). Considerably greater was the employment provided by the average big contracting firm, taken to be one with 15 or more employees. Employment provided by such firms varied between a yearly average of 65 and 104. For the nine years, 1934 to 1942, big contracting firms gave employment on an average to 86 persons. There is no doubt that in Canada as well as in the United States a major section of employment is provided by a comparatively small group of big contracting firms.

Comparison with the United States

The United States Construction Census for 1939 showed about 215,000 contractors of all types conducting a business of over 4.5 billion dollars. Of this amount, 77 per cent or nearly 3.5 billion dollars worth of business was done by a small group of contractors with an annual turnover of $25,000 or more. This group included about 31,000 or 14 per cent of the total number of contractors. In other words, 14 per cent of all contractors did 77 per cent of all the business.

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(1) Wage earners reported in the Construction Census can not be compared with figures available in the Employment Reports for firms with fifteen or more employees. Not only is the base different but figures for wage earners in the Construction Census include also working proprietors who are not included among wage earners enumerated in the Employment Reports. The Dominion Bureau of Statistics could accomplish a highly commendable task if it could bring employment figures available in the Construction Census into line with the employment figures in construction, available in the Employment Reports.

TABLE I.

REPORTS RECEIVED FROM CONSTRUCTION FIRMS AND EMPLOYMENT REPORTED

1934 - 1942.

A	B	C	D	E
Years	Number of firms reported in the Construction Census (1)	Number of Persons Employed by Firms Enumerated in B	Number of firms with fifteen or more employees (2)	Number of Persons Employed by firms enumerated in D
1934	7,140	46,479	971	100,580
1935	7,402	63,349	1,010	87,266
1936	9,666	76,832	1,049	72,841
1937	10,548	96,865	1,118	90,616
1938	12,660	96,010	1,211	100,226
1939	13,285	91,147	1,254	110,010
1940	12,551	103,898	1,283	82,765
1941	14,625	139,587	1,376	122,485
1942	--	--	1,453	125,955

(1) Statistics taken from "Reports on the Construction Industry in Canada" published by the Dominion Bureau of Statistics for the years 1934-1941. Firms reported in the Construction Census include general contractors, trade contractors and sub-contractors. In some cases branches of construction firms operating in different towns than the head office are included. Also included are some reports received from firms which are usually not engaged in construction but have done construction work with their own employees (construction undertaken directly by public authorities is not included).

(2) Data supplied by the Employment Statistics Branch of the Dominion Bureau of Statistics. Railway maintenance construction has been excluded from columns D and E. In some cases branches of construction firms operating in different towns than the head office are included. Figures in column C and E cannot be compared because of difference of the base of computation (see text).

TABLE II

EMPLOYMENT PER AVERAGE AND LARGE CONSTRUCTION FIRMS

1934 - 1942 (1)

Year	Number of Employees	
	Average Firm(2)	Big Firm(3)
1934	7	104
1935	9	87
1936	8	70
1937	9	82
1938	8	84
1939	7	88
1940	8	65
1941	10	89
1942	-	87
Yearly Average	8	86

(1) For sources of statistics see Table I.

(2) Employment provided by an average firm is based on data available in the Construction Census.

(3) Big firms are described as those employing 15 or more employees. Data in this column are based on statistics available in the Employment Reports of the Dominion Bureau of Statistics.

FIGURE I

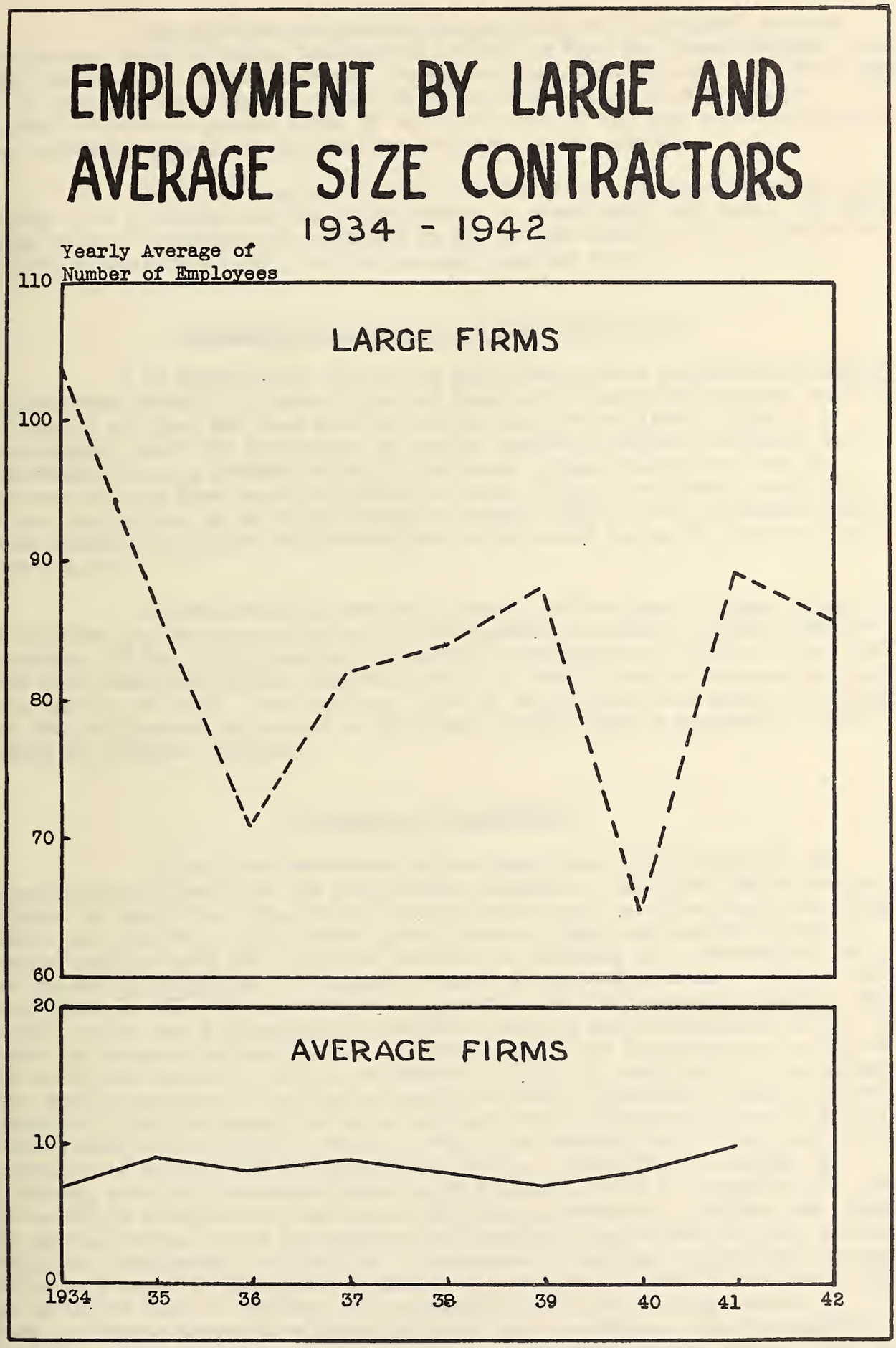

Chart showing for the period 1934 to 1942 employment provided by the average size contracting firm (Construction Census) and by large contracting firms (Reports of Employers with 15 or more Employees). The medium for the nine-year period was 8 employees per average contracting firm and 86 per large contracting firm.

The Canadian Construction Census does not distinguish between contractors doing an annual business of $25,000 or more and those who make less than this amount. It can, however, be assumed that contracting firms which employ 15 or more employees have an annual turnover of $25,000. This group, as pointed out above, employs about 80 to 90 per cent of all wage earners, doing thus the overwhelming part of construction business in this country.

It is of interest to note that the annual business conducted by the average firm in Canada and the United States is practically the same. In 1939, gross value of construction performed by the average American firm amounted to $21,000 as against $22,000. for the average Canadian firm.

Contractors and Builders in the Armed Forces

In August 1942, there were 2,293 contractors and builders reported in the armed forces. Of these 2,156 had been active before enlistment, while 137 or about 6 per cent had been without work before they enlisted. This is considerably below the percentage of persons usually reported unemployed before enlistment, varying between 10 and 12 per cent. Since the report from the Manpower Records Department, on which the above figures are based, cover only about 58 per cent of men in the armed forces in August 1942, it can be assumed that the total number of builders and contractors in the armed forces at that date was around 4,000.

As compared with persons in other professions, a bigger proportion of builders and contractors have made arrangements to return to their civilian vocation. Of the 2,293 reported builders and contractors, 1,204 or 52 per cent have made provisions which, they believe, will enable them to commence business once the war is over. The remaining 1,089 or 48 per cent have made no provisions and some of these might depend on government rehabilitation measures for their return to civilian vocations.

Licensing of Contractors

It has been emphasized before that there are responsible and irresponsible elements in the construction industry. The former group consists of experts in their field who, while looking after their own interests, treat fairly labour and customers. The latter group, however, does not consist always of people familiar with the intricate business of building and construction and are not guided by principles of fairness towards labour and customer. It is beyond doubt that it will not be practical to separate all "white sheep" from the "black sheep" and to avoid irresponsible elements entering the construction field. The question, however, arises whether an effort should not be undertaken to reduce the irresponsible element in the entrepreneurial field of construction to a minimum. This may be achieved by setting up certain minimum requirements which everybody desirous of setting himself up as a contractor or builder would have to fulfil. These requirements could be set by a body of representatives of the construction industry and be approved by governmental bodies. Thereafter, a system of licensing could be introduced under which a licence would be issued to all those presently in business and complying with minimum standards. Anybody new, desirous of setting himself up in the construction business, would have to prove that he meets the requirements set out for a contractor or builder, whereupon a license would be granted to him. Such a licensing system would provide governments with an efficient tool to restrict the entrepreneurial field of construction if too many applicants appear in a short period of boom conditions. Such a measure would mean the protection of the applicants themselves because most of them are likely to fail in their business since boom conditions in the construction industry are only short-lived and this marginal group would be forced out of the construction business in the following period of declining construction activity. Thus, it may be possible to reduce the great number of bankruptcies so common in the construction industry and protect builders, consumers, financial institutions and the public as a whole.

The argument against and for licensing can be shortly summed up as follows: (1)

Con:

(1) There is no need for contractors being experts in their field because architects are supposed to supervise the work of contractors.

(2) There are building by-laws which regulate the safety of construction so that irresponsible builders cannot do much harm.

(3) Municipalities employ inspectors who see that by-laws are carried out.

(4) There are agreements with various labour unions setting forth the scale of wages so that at least a section of construction workers cannot be underpaid.

(5) There are legal provisions which make it impossible to exploit labour (i.e. Industrial Standards Acts).

(6) The Lien Acts protect financial interests in house building and provide some safety against irresponsible builders.

(7) These provisions, legal and otherwise, if properly used should be sufficient to safeguard the interests of the public as a whole. Therefore, there is no need to introduce a licensing system for contractors which would mean an infringement upon "free enterprise."

Pro:

(1) It is commonly known that there are builders who do not consult architects at all. In some cases, architects are engaged as employees and have to carry out the orders of speculative builders who may give little consideration to the usefulness of the design of houses they build. Even in cases where good designs are prepared by architects for builders, there is no guarantee that the projects will be carried out satisfactorily if the builders do not possess the qualifications to do a sound job.

(2) Reports from a number of communities indicate that building by-laws are not always obeyed and that it is difficult to enforce them in all cases. There are no by-laws or city building departments in many municipalities.

(3) Hardly any municipality employs enough inspectors to supervise all construction work undertaken in that community.

(4) Construction trade unions cover only a section of all construction workers. Irresponsible builders are used to cutting wages wherever they can, preferably by employing non-union labour. Trade unions were not successful in organizing construction workers employed by speculative builders (see statement by Mr. A.S. Mathers, Appendix I).

(5) Speculative builders, on the whole, disregard the Industrial Standards Acts by using the system of "labour contract".

(6) Many liens have been put on builders where the money, if received at all, was only a portion of the whole. Neither

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(1) See an address on "Licensing of Building Contractors" by W.B. Sullivan, made at the Fifteenth Annual Convention of the Canadian Construction Association in 1933 (Appendix II).

lien acts nor bankruptcy laws are a safeguard against irresponsible builders.

(7) Provisions, as in existence in this country at present, do not provide any safeguard against irresponsible builders and contractors. A possible answer to the problem of safeguarding the interests of the public as a whole against the action of irresponsible builders would be to make it impossible for anyone to engage as a contractor or builder unless he is considered qualified by his previous training, experience and integrity.

The introduction of a system of licensing is supported by the experience of a considerable number of municipalities in the United States where, throughout the last decade, licensing of contractors has become a frequent measure of safeguarding public interests. It was found in the States that licensing was not only supported by the general public and government agencies, but also by the majority of contractors and builders who thus certified their desire to keep their ranks free from intrusion of irresponsible outsiders.

Nobody questions today that a doctor before opening a practice has to obtain a license. The main reason is that we do not entrust human lives to unqualified men. Why not ensure likewise that large scale house building is entrusted to men who have the qualifications to build good housing? Is not satisfactory housing with which design and proper house building are closely connected, a matter of primary importance? We are aware that a considerable residential construction programme expects this country in the post-war period. Is it desirable to have a great number of irresponsible builders reaping great profits by damaging the economy of this country and the well-being of thousands of Canadians? Many will agree that the problem of licensing deserves serious consideration now if chaotic conditions in house building are to be avoided in the post-war period.

If a certain minimum standard for the construction industry is assured, it should be possible to induce large and responsible building firms to enter the field of residential construction. Dr. W.C. Clark pointed out in 1937 that this should be possible if large concerns would only realize that an enormous market in the field of low-cost housing remains to be exploited by bringing to bear efficient business methods, adequate financial resources, adequate knowledge of sound planning and layout and a measure of promotive and selling ingenuity on the problem of providing shelter accommodation for the mass of people of a sound quality and at a price which they can afford to pay. It is reasonable to expect that the public would respond to a constructive effort of this type so that big firms may be enabled to carry out their planning, purchasing and building co-operation on such a scale as to achieve the maximum practicable economies of large-scale operations. If large building concerns could meet the demands for low-cost housing, they would make an important contribution to the economy and welfare of this country. This can, in Dr. Clark's opinion, only be achieved if large firms operate on a regional or national basis in order to secure the advantages of large-scale and greater stability than are possible in localized operations. What Dr. Clark pointed out in 1937 still holds good today and deserves immediate attention of all those concerned with the role which the construction industry might play in the post-war period.

A survey of opinions of responsible builders leaves the impression that a number of firms, hitherto engaged in large-scale construction in fields other than residential, would be willing to enter the residential field in the post-war period if the Government offered them sufficient encouragement. For example, the Canadian Construction Association resolved at its annual meeting in 1942 to offer its co-operation for post-war planning and asked the Government to indicate in what way big contractors in this country could prepare for the requirements for construction in the post-war period. One year later, at the Annual Convention of the Canadian Construction Association in 1943, it was noted with regret that such a lead, as asked for in 1942, has not been forthcoming from the Government.

There is hardly any doubt that a clear statement from responsible quarters could spur the construction industry to make preparations for the task ahead of them. What is required is a statement that this country is going to experience in the post-war period a development which has hitherto not been known and that this would include construction of residential dwellings and public facilities on an unprecedented scale, the extent of the latter partly depending on the efficiency with which the construction industry will be able to carry out its share of the development programme. Such a statement, if forthcoming in the not too distant future, would create great enthusiasm among the public as a whole and the industries concerned in particular, and would lead to considerable post-war planning by those concerns which will have to carry out the overwhelming part of the development programme.

II. ORGANIZATION OF THE CONSTRUCTION INDUSTRY

The organization of the construction industry proper is marked by the great number of organizations and the comparatively small number of members.

The latest report on the organization of industry prepared by the Department of Labour lists 33 main organizations and 36 affiliated or branch associations, a total of 69 organizations with a reported membership of 3,605. (1)

Some changes have taken place since the last report was published in 1938 but no accurate records are available for recent developments. Some organizations have disappeared and new ones have come into existence. Nevertheless, there have been no radical changes either in the form of organization or in the number of members of organized building industry in recent years. Figures available are sufficient to give some idea of organized entrepreneurs in this industry.

The organized groups in the construction industry are classified by the Department of Labour as follows: Canadian Construction Association and affiliations, painters and decorators, plumbers, electrical contractors and other builders' associations.

Comparison with Other Industries

If the organization in the construction industry is compared with that of other industries, the diversity of organization in the construction field becomes obvious. The following table shows that the reported membership by groups was lowest for the construction industry and highest for the mining industry. In the former group there were on an average only 52 members to each organization, while in the latter there were 245 members to each organization. Table III is illustrated in Figure II, shown on the following page.

TABLE III

ORGANIZATION OF INDUSTRY BY GROUPS AND MEMBERSHIP(2)

Type of industry	Number of organizations including affiliated and branch associations	Reported membership	Number of members per organization
Building and construction	69	3,605	52
Manufacturing	93	12,524	135
Mining	12	2,936	245
Transportation and communication	48	6,057	126
Printing and publishing	43	2,556	59

(1) Department of Labour: "Twelfth Report on Organization in Industry, Commerce and the Professions in Canada," Ottawa, 1938, p. 8.

(2) Table compiled from statistics available in "Twelfth Report on Organization in Industry, Commerce and the Professions in Canada," Department of Labour, Ottawa, 1938, pp.8-9.

FIGURE II

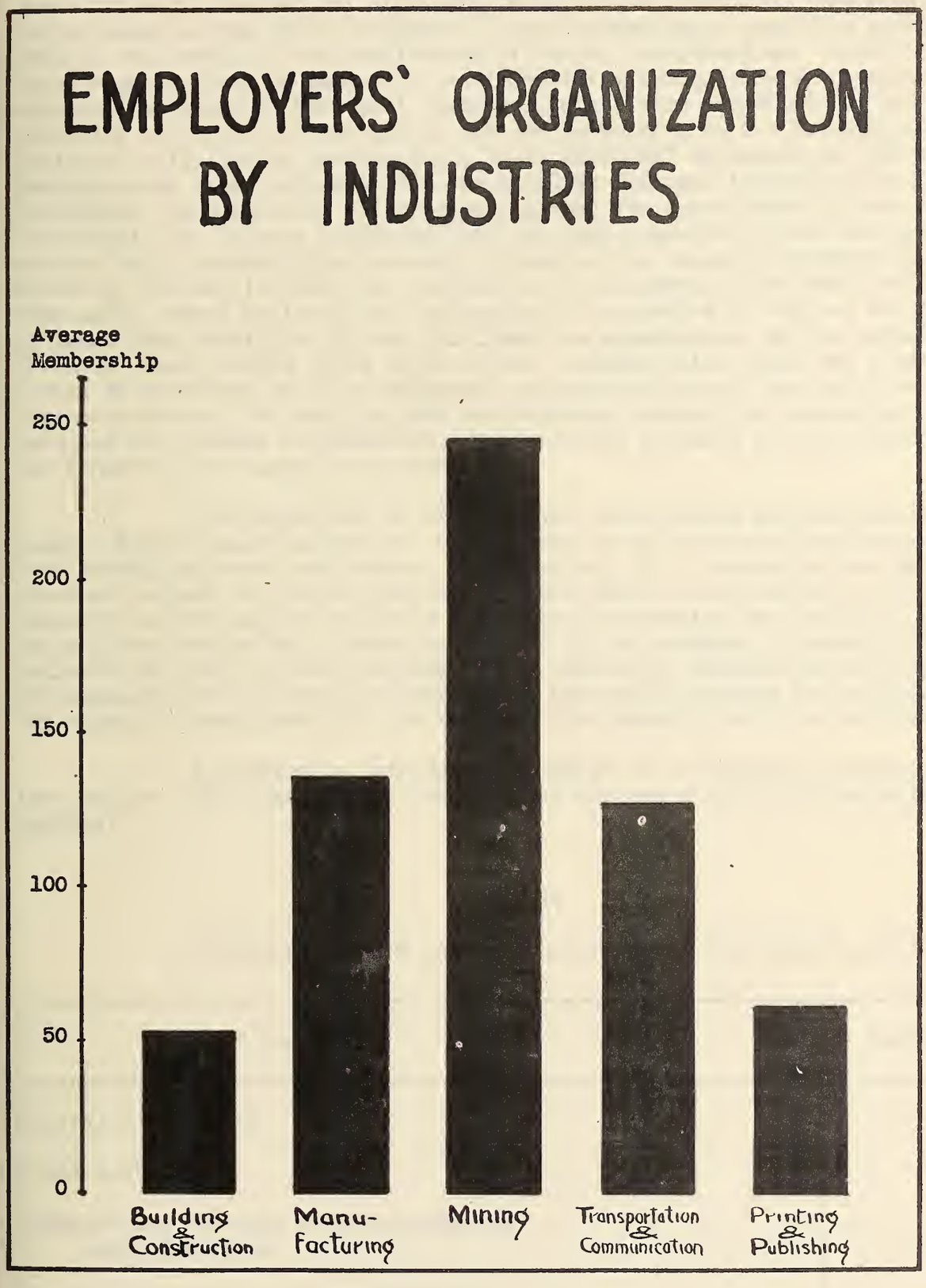
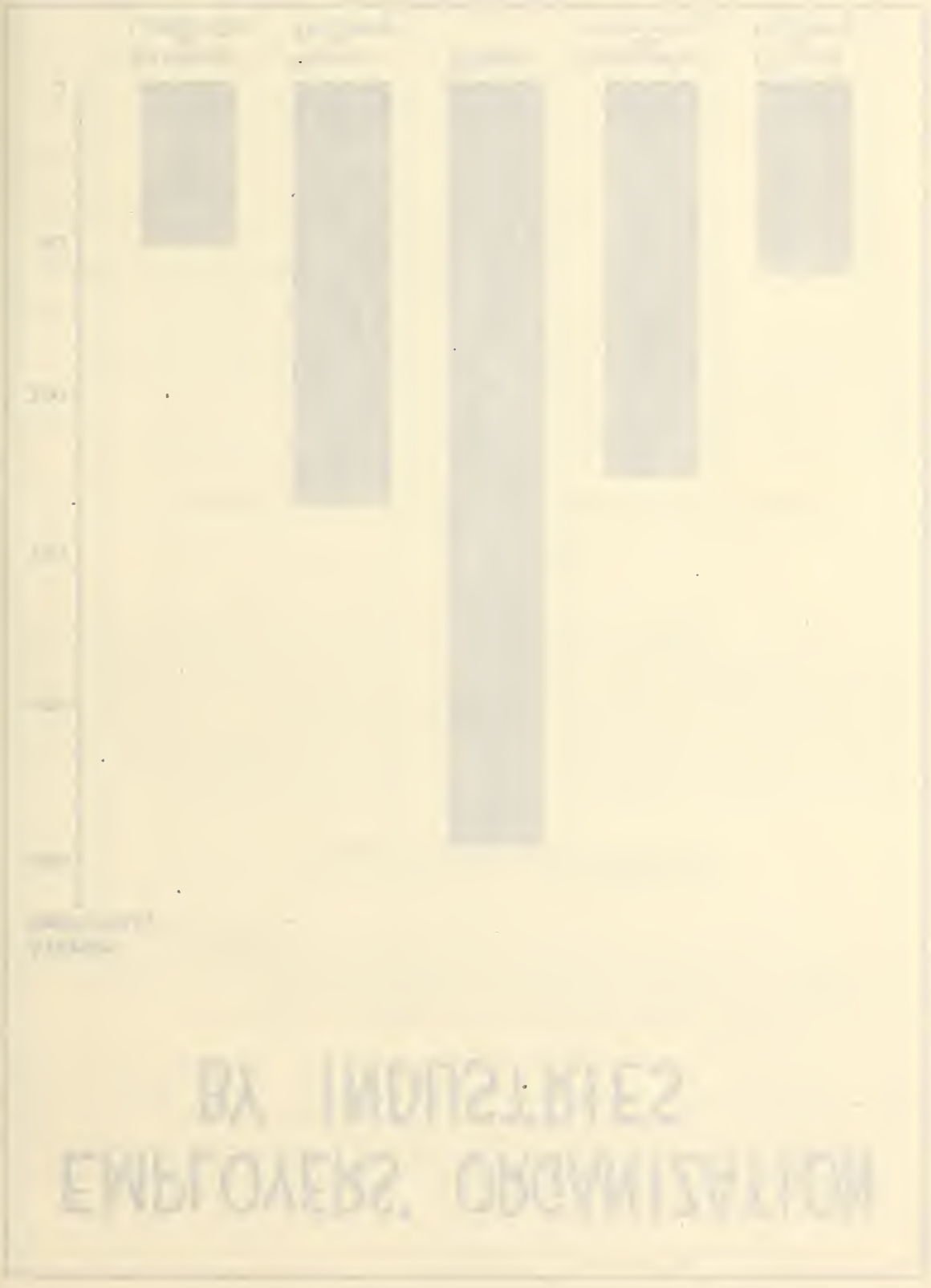


Chart showing the average membership per employers' organization in 5 branches of Canadian industries. Source: Department of Labour, "Organization in Industry, Commerce, and the Professions in Canada, 1937".



Canadian Construction Association

The main body representing the building industry in the Dominion is the Canadian Construction Association which was originally known as the Association of Canadian Building and Construction Industries (the present title being chosen at the 1928 conference). This organization came into existence in 1919 as the result of the unification of several associations. Prior to 1906, group organizations of employers in the building trades chiefly consisted of local associations known as builders' exchanges, which were organized for the purpose of promoting uniformity of methods in matters pertaining to the building industry. Aiming at still closer co-operation, these builders' exchanges in 1906 formed a Dominion-wide organization called the Canadian National Association of Builders' Exchanges. Then, in 1913, after operating thus for seven years, it was decided at a convention in Calgary to divide this National Association into two groups--an eastern and a western division--with Ottawa as the general headquarters. With the advent of the war in 1914, the activities of the organization were curtailed, and eventually ceased to function. Following the cessation of the war and the return to peace time conditions it was felt that the organization of the industry on a permanent basis should again be effected. Consequently, there was a meeting at Ottawa in November, 1918, of builders, contractors, supply men and other dealers, representative of the building and construction industry in Canada, out of which resulted the present organization. Conferences, attended by representatives of the industry, are being held annually.

The objectives of the Canadian Construction Association are: (1) To promote better relations between the members on the one hand; and owners, architects, engineers and labour, on the other; (2) to establish and maintain standard methods of practice between members within the industry; (3) to acquire, preserve and disseminate valuable information concerning the industry; (4) to extend construction and improve conditions in the combined industry; (5) to co-ordinate the units of the industry in its producing, manufacturing, distributing, professional and constructive activities, thereby increasing its efficiency and extending its usefulness, to the end that the industry shall be stabilized.

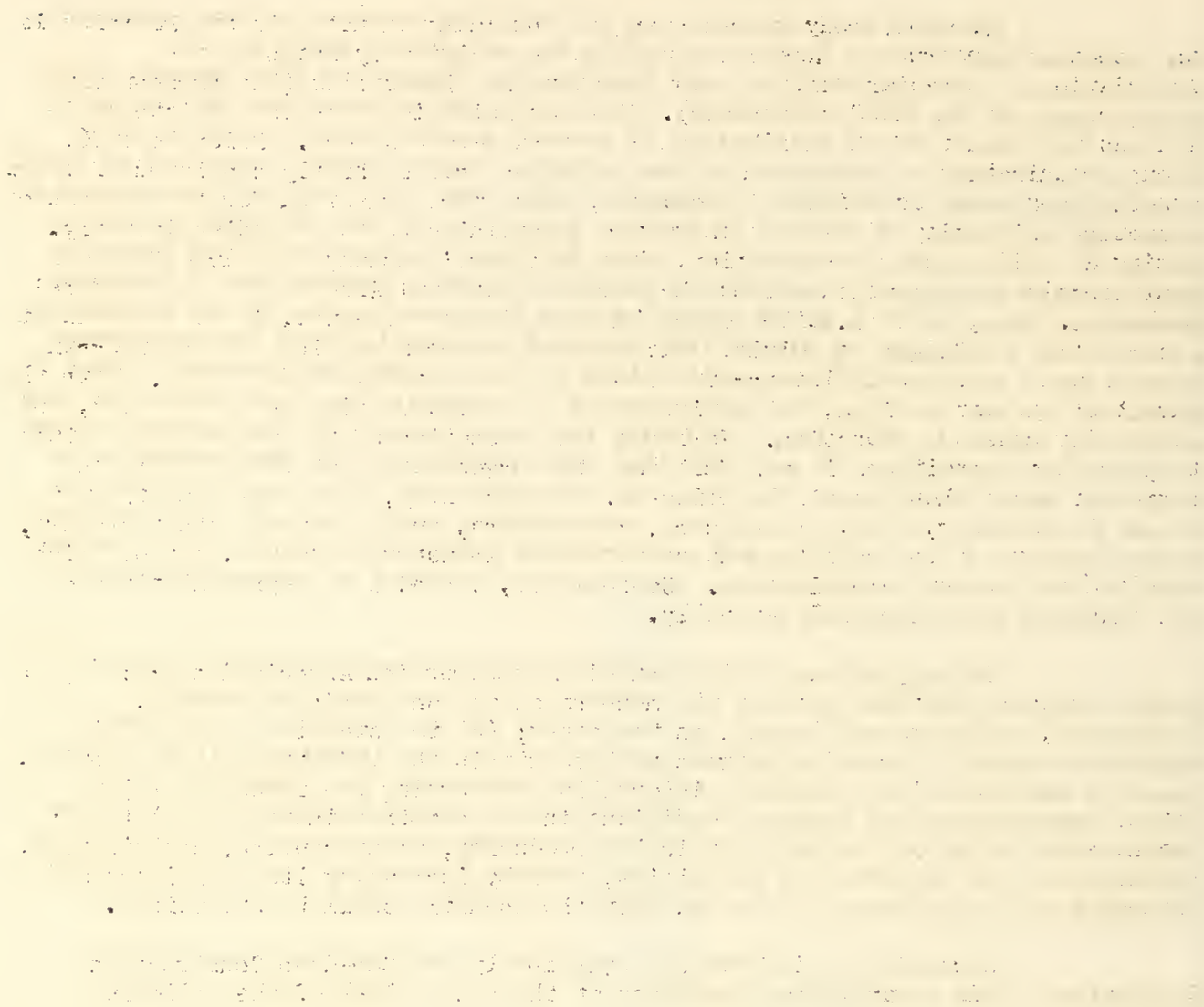
According to information supplied by the Canadian Construction Association, this organization consisted at the end of 1942 of the following members;

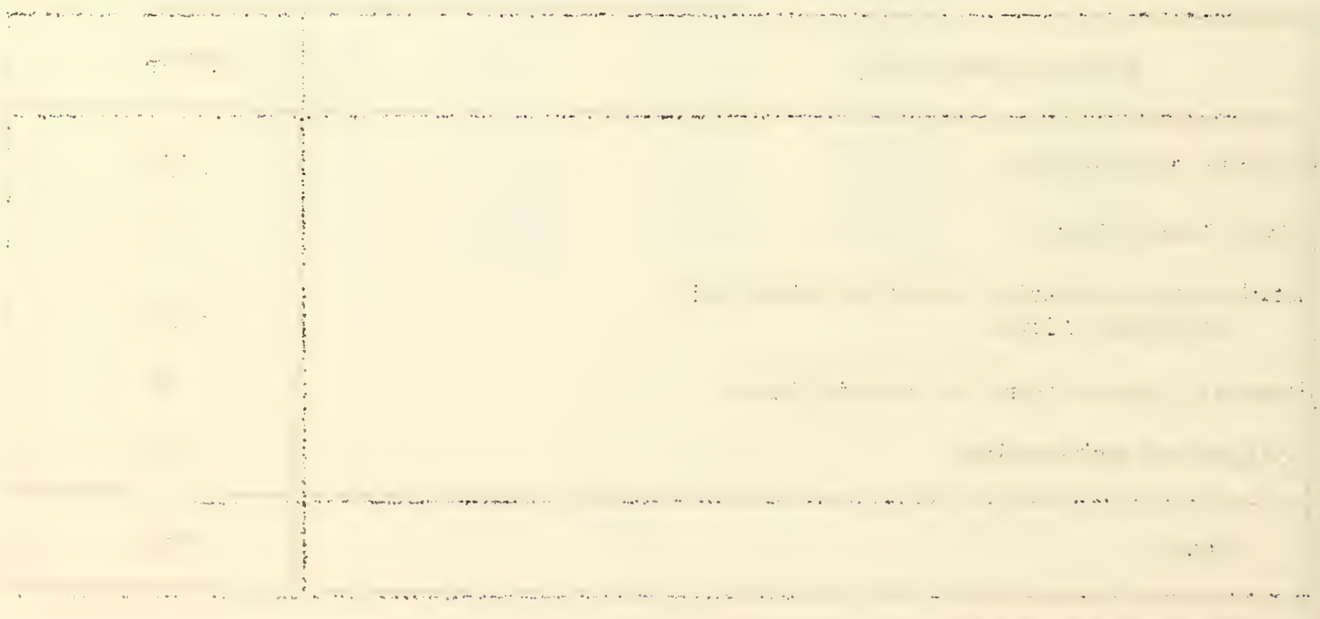
TABLE IV

MEMBERSHIP OF THE CANADIAN CONSTRUCTION ASSOCIATION, 1942 (1)

Type of membership	Number
General contractors	135
Trade contractors	81
Construction material manufacturing and supplying firms	156
Special institutions or associations	8
Collective memberships	16
Total	396

(1) Data supplied by the Canadian Construction Association, Ottawa, February 1943.





Local exchanges and associations holding collective membership in the Canadian Construction Association classified according to the type and membership and by regions is shown in Table V on the following page. L'Association des Constructeurs de Quebec has the greatest membership, namely 226. It is followed by the Builders' Exchange, Montreal, with 204, Builders' Exchange and Construction Association of Toronto with 158, and the Hamilton Construction Association with 108.

The Canadian Construction Association includes, besides 216 general and trade contractors among its members, 897 general and trade contractors through its affiliate organizations, a total of 1,113. This represents only about one-tenths of the total number of general and trade contractors in this country. Nevertheless, the Canadian Construction Association claims that 50 per cent to 60 per cent of all construction activity carried out in Canada by general and trade contractors is done by the members of the Association. This claim is supported by the fact that a great number of large-scale operators are among the members of the Canadian Construction Association.

Painters and Decorators

"The Canadian Council of Master Painters and Decorators" was established in February 1904. The jurisdiction of this Association extends from Ontario eastwards to the Atlantic Coast. But the membership is chiefly confined to the Province of Ontario.

Among the objects of this association are: (1) To encourage the formation of local Associations for the purpose of mutual improvement among master painters and decorators, and to elevate the craft generally; (2) to adopt the establishment of the national apprenticeship system, whereby young men desirous of acquiring trades may be duly indentured and properly taught and a certificate of workmanship given.

Another organization is the "Master Painters and Decorators' Association of British Columbia" which was organized in 1924 and incorporated in 1927. Its objects are similar to those of the Canadian Council of Master Painters and Decorators.

Plumbers

The outstanding institution of master plumbers is the "Canadian Institute of Plumbing and Heating" which was organized in February 1933. Its objects are: (1) To raise and maintain the standard of the plumbing and heating business and industry throughout Canada by educating the general public to a realization of the usefulness and increasing necessity and the extent and size of such business and industry as well as otherwise; (2) to establish, maintain, operate, administer, supervise, control and manage, either alone or in connection with any person, firm, corporation, association, body, institution, government, or authority, any buildings, work, conveniences, laboratories or organizations for technical research or experiments; (3) to promote investigation and study of all matters of general interest to manufacturers, wholesale distributors, jobbers or manufacturers' agents engaged in such business and industry; arbitration in case of dispute affecting members of the institute; the making and enforcing of agreements for the benefit of its members; the collection, classification and distribution to members of all statistics of any value directly relating to the plumbing and heating business and industry; the encouragement of frank interchange among the members of information that would in any way assist in stabilizing or otherwise improving the conditions under which the plumbing and heating business is carried on; (4) to generally promote the interests and conserve the rights of those engaged in the plumbing and heating business and industry; (5) to maintain and continue, by social intercourse, the good feeling at present existing among the persons engaged in the plumbing and heating business and industry as well as with persons dealing with them; (6) to invest and deal with the moneys of the company not immediately required in such manner as may from time to time be determined.

TABLE V

COLLECTIVE MEMBERSHIP IN THE CANADIAN CONSTRUCTION ASSOCIATION BY GROUPS, 1942 (1)

Name of organization	General contractors	Trade contractors	Manufacturing and supply	Total
Edmonton Builders Exchange, Incorporated.	9	31	23	63
Hamilton Construction Assn.	10	63	35	108
Kitchener-Waterloo Builders Exchange	7	15	24	46
Builders Exchange of the City of London	16	17	26	59
Builders Exchange, Inc., Montreal	49	95	60	204
L'Association des Constructeurs de Quebec	60	135	31	226
Regina Builders Exchange	7	29	22	58
St. John Branch, Canadian Construction Association	12	24	27	63
Saskatoon Construction Assn.	7	14	18	39
Builders Exchange and Construction Association of Toronto	34	62	62	158
Building and Construction Industries Exchange of British Columbia (Vancouver)	12	36	38	86
General Contractors Association of Vancouver	22	--	--	22
Victoria Builders Exchange, Ltd.	17	29	6	52
Builders & Contractors Association of Essex County (Windsor)	7	21	22	50
Winnipeg Builders Exchange	16	41	42	99
Total	285	612	436	1,333

(1) Data supplied by the Canadian Construction Association, Ottawa, February 1943.

Another organization is the "Canadian Automatic Sprinkler Association" which was organized in 1919 and whose objects are similar to those of the Canadian Institute of Plumbing and Heating, giving special reference to the development of the automatic sprinkler art.

Among the other plumbing associations, those of more importance are enumerated in the following: (1) Moncton Society of Domestic, Sanitary and Heating Engineers, (2) Master Plumbers' Association of Montreal and Vicinity, (3) Ottawa Master Plumbers' Association, (4) Ontario Society of Domestic Sanitary and Heating Engineers, (5) Toronto Society of Domestic Sanitary and Heating Engineers, (6) Manitoba Provincial Association of Sanitary and Heating Engineers, (7) Greater Winnipeg Association of Sanitary and Heating Engineers, (8) Saskatchewan Society of Sanitary and Heating Engineers, (9) Alberta Association of Domestic, Sanitary and Heating Engineers, Inc., (10) Calgary Association of Domestic, Sanitary and Heating Engineers, (11) Vancouver Sanitary and Heating Association (Inc.), (12) Victoria Sanitary and Heating Trades' Society.

Electrical Contractors

The biggest organized group of electrical contractors is the "Ontario Electrical Contractors' Association" which was organized in 1930. The objects of this association include (1) the advancement and the furthering of closer relations between the members and the employees, jobbers and manufacturers; (2) co-operation of the members with the electrical inspection department of the Hydro-Electric Power Commission and the standardization of the rules and regulations of the Hydro-Electric Power Commission; (3) in favour of legislation respecting the licensing of electrical contractors, electrical dealers and journeymen electricians; (4) to establish and maintain standard methods of practice and to improve the service rendered to the public. Affiliated with this organization are a number of local branches.

Other organizations of importance in the electrical field are: (1) The Electrical Association of Ottawa, (2) Eastern Ontario Electrical Association, (3) The Toronto Electrical Contractors' Association, (4) Saskatchewan Electrical Contractors' Association, (5) Alberta Electrical Association, (6) Vancouver Electrical Association, (7) Vancouver Association of Electragists, formerly Electrical Contractors and Dealers' Association (affiliate of the National Association of Electragists, with headquarters in the United States), and (8) Electric Service League.

Other Builders' Associations

Other associations of employers in the building trades for which particulars have been secured by the Department of Labour include the "Contracting Plasterers' Association of Canada," an organization affiliated with the "Contracting Plasterers' International Association. This organization in existence since 1923 has a number of branches over Canada. Its main object is to promote uniformity of action in all matters affecting the interests of the membership, and to create and maintain a mutual feeling between employer and employee.

Other organized groups in the construction industry are: (1) Master Plasterers' Contracting Association of Calgary, (2) Canadian Cut Stone Contractors' Association, (3) National Crushed Stone Association, Inc., (4) Toronto Home Builders' Association, and (5) Association of Plumbing and Drain Inspectors of Ontario.

Organization in House Building

The house building industry is the least organized section of the construction industry as a whole. There does not exist yet any nation-wide organization representing house builders in Canada, although attempts are being made at the present time to bring such an organization into existence. The lack of organization in the house building field has caused great harm to the house

building industry. Professor J. A. Coote pointed out that "the house builders are unorganized and many, if not most of them, are speculators rather than builders."(1)

As has been said before, quite a number of speculative builders are less interested in maintaining standards than in producing housing units at minimum cost and selling them at the highest possible price.

In the field of residential construction, the only organized groups of importance are Home Builders' Associations in Toronto and Vancouver. The "Toronto Home Builders' Association", organized in 1921, had 198 members in 1937.

The need for nation-wide organization of the construction industry as a whole, particularly in the house-building field, is clearly indicated. Such an organization could establish standards of good practice and assure equitable treatment of clients and employees.

Recently, there has been concrete recognition of the need to distinguish between the irresponsible builder as compared with the reputable builder who is concerned not only with his own interests but also with those of his workmen and clients. Early in 1943, a group of reliable and reputable house builders formed a new national organization known as the "National House Builders' Association." They have since been granted a charter by the Dominion Government.

The objectives of this association are: (1) to associate the home builders of Canada for purposes of mutual advantage and co-operation; (2) to improve the quality and character of homes for the Canadian people; (3) to develop and establish standards of practice for those engaged in home building; (4) to exchange experience and information among those engaged in home building; and (5) to represent its members in matters of national, provincial and local policy and legislation affecting home building.

To assure that only builders who are reliable and responsible persons and are willing to subscribe to the objectives of the National House Builders' Association shall become members. Article IV of the By-Laws provides that operating membership in this association shall be open to any individual who (a) demonstrates to the satisfaction of the Admissions Committee that he is an experienced builder of homes, and (b) is an operative or contract builder of residential structures or a developer of home sites. A further provision gives a disciplinary committee the power "to reprimand, censure, fine, or expel any operating member for violation of the standards of practice established by the Association. No disciplinary action shall be taken until a member against whom complaint is made shall have had fair opportunity for a hearing."

The forming of this association marks an important development in the history of organization of the construction industry in this country. It indicates the desire of a group of builders to separate themselves from those who because of their unfair practices have undermined the good name of the Canadian contractor or builder.

It further marks the recognition of the need to co-ordinate the efforts of all house builders in this country. The number of builders is great. Most of them are small men building only a few houses a year, and therefore not equipped to apply modern techniques and labour-saving devices. The temporary president of the National House Building Association explained that among other aims would be the co-ordination of the efforts of medium and small builders in local areas. In practice, this may mean co-operative ownership of modern machinery and more continuous employment for employees of this builders' group. Although there lie great difficulties ahead for this association, the initiative taken by a number of responsible builders is commendable and will probably form the basis for further organizational development in the post-war period.

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(1) J.A. Coote: "Impact of Wartime Controls on Construction Industry," report submitted to the Advisory Committee on Reconstruction, Ottawa, 1942, p. 2.

A proposal for the improvement of the organization of the construction industry has come from Mr. Mathers who believes that it would be desirable to induce responsible contractors to enter the field of residential construction. By dealing fairly with the customer and the construction labour force, the irresponsible type of speculative builders could be removed from their present role in the house building field. Although Mr. Mather's recommendations (see Appendix I) relate only to a few of the problems concerned with the improvement of the organization of the construction industry and represent only one of the many ways in which the problem can be approached, his proposals deserve serious consideration. They form a welcome basis for a discussion by those interested in solving the difficulties which the construction industry faces presently and which this industry is going to face many times intensified in the post-war period.

National Construction Council

When the depression hit the construction industry particularly hard in 1933, industry and labour felt that only a concentrated effort of all interested in the fate of this industry would make it possible to overcome the crisis. The result was a conference of all national organizations interested in the construction industry, which took place in Toronto in February 1933.

The following national bodies were represented: The Royal Architectural Institute of Canada, Engineering Insitute of Canada, Canadian Construction Association, Canadian Manufacturers Association, Canadian Chamber of Commerce, Canadian Lumbermen's Association, Brick Manufacturers Association, Canadian Council of International Society of Master Painters and Decorators, Canadian Founders and Metal Trades Association, Canadian Hardwood Bureau, Canadian Automatic Sprinkler Association, Contracting Plasterers' Association of Canada, Electric Service League, Structural Clay Tile Association, Canadian Paint Oil and Varnish Association, Canadian Institute of Stool Construction, Trades and Labour Congress of Canada, and the Canadian Ceramic Society.

These bodies formed a new national organization named the "National Construction Council of Canada." Its declared objectives were (1) to unify the construction industry, that it may plan its future and present its aspirations as an industrial unit; (2) to stabilize the industry, eliminate waste, improve its ability to serve the public, develop its structural and economic plans, minimize unemployment and consolidate parallel endeavours; (3) to enable leaders of national bodies to automatically confer together for mutual benefit and industrial progress; (4) to furnish an industrial tribunal to promote justice, encourage constructive measures for or within the industry, and courageously oppose destructive measures against or without the industry; (5) to promote fair professional ethics and business practices; (6) to promote higher standards of living, meet competition of other industries, support timely movements for proper and efficient public works and encourage sound financing and investments in construction projects; (7) to promote better public relations; (8) to collect and disseminate such data and information to the affiliated bodies or the public as may be deemed necessary or advisable from time to time; (9) to foster and co-ordinate industrial and scientific research in the construction industry and its component parts; and (10) to provide adequate facilities to accomplish these objects.

The objectives of the National Construction Council were drawn up with great foresight and understanding of the needs of the industry. It is therefore regrettable that this organization has been mainly concerned for the last decade with special ad hoe problems and that it has not received the support from its members which would have made it possible to carry out all its objectives.

The National Construction Council considered as its primary objective the unification of the construction industry, "that it may plan its future and present its aspirations as an industrial unit." However, the majority of contractors and builders in this country are still unorganized. Furthermore, a number of small organized groups remain outside the National Construction Council.

With the exception of general statements, little has been done to foster and co-ordinate industrial and scientific research in the construction industry and its component parts. Although responsible members of the construction

industry recognize the need for planning measures to assist the stabilization of the industry, to eliminate waste and improve the structural set-up (that is the integration of the industry) the National Construction Council has, as yet, brought forward no concrete proposals. This, in spite of the fact that objectives (2) and (9) provide that the National Construction Council be charged with plans to "stabilize industry, eliminate waste, improve its ability to serve the public, develop its structural and economic plans, minimize unemployment and consolidate parallel endeavours" and "to foster and co-ordinate industrial and scientific research." This is a particularly important type of work which the National Construction Council should undertake for the purpose of protecting its own members from the consequences of a depression which is likely to follow a post-war building boom.

If the National Construction Council had succeeded in achieving its fourth objective, namely "to furnish an industrial tribunal to promote justice, encourage constructive measures for or within the industry and courageously oppose destructive measures against or without the industry," the irresponsible element among speculative builders might have been reduced and less harm been done to the residential construction field.

There is no doubt that the public would welcome statement and information from a central organization of the construction industry to the effect that it can expect satisfactory services because of improved organization within the industry. This is provided for in objective (7) which advocates the promotion of better public relations.

Summarizing, it must be said that the National Construction Council has failed in accomplishing the broad aspects of its objectives. For this failure the lack of interest, mainly among the more important members of the industry, is to blame.

Nevertheless, as has been pointed out before, there exists in Canada a basic need for a central organization of members of the construction industry in its widest sense, including contractors, architects, engineers, manufacturers and distributors of building materials and construction workers. It is of minor importance whether a new organization be formed or the frame-work of the National Construction Council used to attain purposeful co-ordination in the construction industry. If, in the post-war period, the National Construction Council can be developed into an organization which will include the rank and file of the construction industry, then it will be able to look after the interests of the construction industry, described so well in the objectives formulated in 1933.

In particular, this organization would have to attach great importance to a study of stabilizing the construction industry in the post-war period (see point 2 of the objectives), to a promotion of fair business practice (see point 5) and to an efficient co-ordination of industrial and scientific research in the construction industry and related industries (see point 9). If this could be accomplished, the National Construction Council could make an important contribution to solving the post-war problems of the construction industry.

III. THE ORGANIZATION OF THE CONSTRUCTION LABOUR FORCE.

Compared with other industries, construction workers are well organized. They rank third among industry groups, following railroad transport and metal industry.

Construction workers are organized in trade unions. Most of the "local unions" in Canada are branches of trade unions, many of which are international organizations having branches both in Canada and in the United States and, in some cases, in Newfoundland, Mexico, Panama Canal Zone, or the Phillippines. The Canadian locals of these international unions are, in most cases, affiliated with either of two Canadian central bodies, the Trades and Labour Congress of Canada or the Canadian Congress of Labour. The Canadian locals which are branches of unions affiliated in the United States with the American Federation of Labor are affiliated with the Trades and Labour Congress of Canada, and those which are branches of international unions affiliated in the United States with the Congress of Industrial Organizations are affiliated with the Canadian Congress of Labour. Each of the Canadian Congresses has affiliated with it also a number of purely Canadian organizations, most of them trade unions with branches in different places and some merely local unions. The latter are directly chartered by one of the Congresses. Some local unions affiliated with the Trades and Labour Congress are directly chartered by the American Federation of Labor. A local union may be a "federal union" covering workers in different trades or industries or it may be a union which, later joining others in the same trade or industry, becomes a branch of a national union.

There are three principal central labour organizations which have members in Canada only: the Confederation of Catholic Workers of Canada with which are affiliated most of the National Catholic Unions, the Canadian Federation of Labour and the One Big Union.(1)

Organized Workers in Construction and other Industries

Table VI shows the distribution of trade union membership among the main industrial groups in 1940 and 1941 (see also Figure III). There were nearly ninety thousand persons organized in the railroad transportation, about seventy-four thousand in the metal industry and about forty-one thousand in the building industry. These industries were followed by the transportation industry other than railroads, mining and quarrying, public employees, wearing apparel industry (clothing, boots and shoes) and printing and paper making. It is noteworthy that besides the unions whose members are engaged chiefly in construction, unions under the heading "building" include, for example, carpenters in woodworking shops and electrical workers on electric railways, in railway shops and in light and power plants.

The increase in the membership of the trade unions was greater than it appears from Table VI. The Department of Labour changed in 1941 the base of membership composition of trade unions by excluding a number of organizations of local character which in the opinion of the Department of Labour should not be regarded as trade unions. The latest report, however, gives unadjusted figures for 1940 and adjusted figures for 1941. It can therefore be readily observed that the increase in membership in trade unions in 1941 over the 1940 level was greater than 28 per cent as indicated by the figures given in Table VI.

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(1) Department of Labour: 31st Annual Report on "Labour Organization in Canada", Ottawa, 1943, P. 5.

TABLE VI

MEMBERSHIP IN TRADE UNIONS, BY INDUSTRIES, 1940 and 1941. (1)

INDUSTRY GROUP	1940	1941	
	Number	Number	Percent
Mining and Quarrying	28,641	38,678	8.39
Building	40,479	41,106	8.90
Metals	39,800	73,836	15.99
Printing and Paper Making	25,835	29,758	6.45
Clothing, Boots and Shoes	29,348	30,400	6.58
Railroad Transport	83,142	89,727	19.43
Other Transport	29,712	38,831	8.41
Public Employees, Personal Service and Amusement	39,807	36,640	7.94
Other Trades and General Labour	48,780	82,705	17.91
	365,544 (2)	461,681	100

(1) Table compiled from 31st Annual Report on "Labour Organization in Canada", Department of Labour, 1943, pp. 9-10.

(2) In previous reports on the Labour Organization in Canada, including that for 1940, certain organizations were included which are omitted from the thirty-first report (1941) on the ground that they cannot be properly regarded as Trade Unions. The Department of Labour comments that because of the change of the base the increase in Trade Union branches and membership is considerably greater than appears from a comparison of the 1941 figures with those for 1940.

FIGURE III

TRADE UNIONS IN CANADA
BY GROUPS OF INDUSTRIES
1941

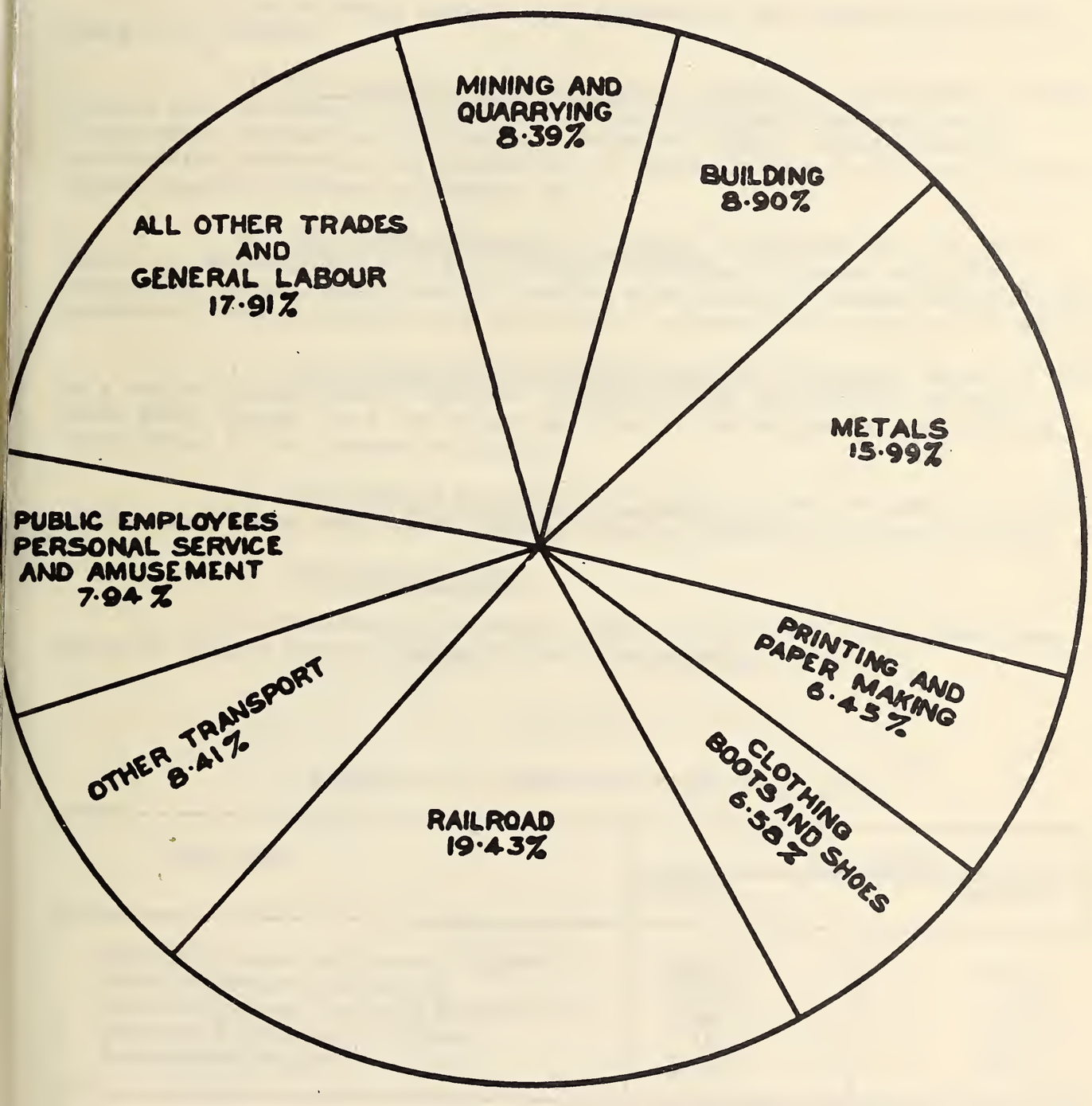
MINING AND QUARRYING 8·39%
BUILDING 8·90%
METALS 15·99%
PRINTING AND PAPER MAKING 6·45%
CLOTHING BOOTS AND SHOES 6·58%
RAILROAD 19·43%
OTHER TRANSPORT 8·41%
PUBLIC EMPLOYEES PERSONAL SERVICE AND AMUSEMENT 7·94%
ALL OTHER TRADES AND GENERAL LABOUR 17·91%

Chart showing the relative strength of trade unions in 8 selected industries and all other trades. Source: Department of Labour, "Labour Organization in Canada", 1941.

PLATE III

TRADE UNIONS IN CANADA
BY GROUPS OF INDUSTRIES
(1941)

MINING AND QUARRYING 6.32%
ALL OTHER TRADES AND GENERAL LABOUR 17.91%
PUBLIC EMPLOYEES PERSONAL SERVICE AND AMUSEMENT 7.04%
OTHER TRANSPORT 8.41%
RAILROAD 19.43%
CLOTHING BOOTS AND SHOES 6.36%
PRINTING AND PAPER MAKING 6.43%
METALS 13.92%
BUILDING 8.95%

Chart showing the relative strength of trade unions in 9 selected industries and all other trades. Source: Department of Labour, "Labour Organization in Canada", 1941.

This is especially marked for construction where practically no increase is shown in the report of the Department of Labour. It is known, however, that construction trade unions have been constantly increasing their membership since the outbreak of war. A clear indication of this fact will be found from a study of the increase in the number of locals of construction trade unions affiliated with the Canadian Trades and Labour Congress. In September 1942, locals had increased by 10 per cent over the number existing in 1940 (see Appendix III).

Trade Union Members in Construction Industry.

The following trade union organizations have construction workers among their members:

(1) The Canadian Trades and Labour Congress, established in 1886, permits only craftsmen as its members. Being the biggest organization of construction craftsmen as its members. Being the biggest organization of construction craftsmen, some information on unions affiliated with the Trades and Labour Congress is given in Appendix III.

(2) The Canadian Congress of Labour, established in 1917, is the result of the amalgamation of the Canadian Federation of Labour with other independent unions, among them the Canadian Brotherhood of Railway Employees. This organization accepts skilled and semi-skilled and unskilled workers as its members.

(3) The Confederation of Catholic Workers of Canada, formed in 1921, is a central organization of National Catholic Unions in existence in Canada since 1901. Except for a few in Eastern Ontario, the National Catholic Unions are confined to the Province of Quebec.

(4) The Canadian Federation of Labour, in its new form, is a result of the secession of some unions from the Canadian Congress of Labour in 1936.

(5) Independent Unions.

The distribution of members among the different construction trade unions in 1941 is shown in Table VII and illustrated in Figure IV.

TABLE VII

MEMBERSHIP OF CONSTRUCTION TRADE UNIONS 1941.(1)

TRADE UNION	MEMBERSHIP	
	Number	Percent
Canadian Trades and Labour Congress	23,413	57.0
Canadian Congress of Labour	3,136	7.6
Confederation of Catholic Workers (2)	9,440	23.0
Canadian Federation of Labour	125	0.3
Independent Unions	4,992	12.1
TOTAL	41,106	100.0

(1) Table compiled from data supplied by the Department of Labour, March 1943.

(2) The National Catholic Federation of Building Trades, a member of the Confederation of Catholic Workers of Canada, reported 14,290 members for 1941. Local unions affiliated with the Federation reported 9,440 members, this figure being used in the official compilation of the Department of Labour.

FIGURE IV

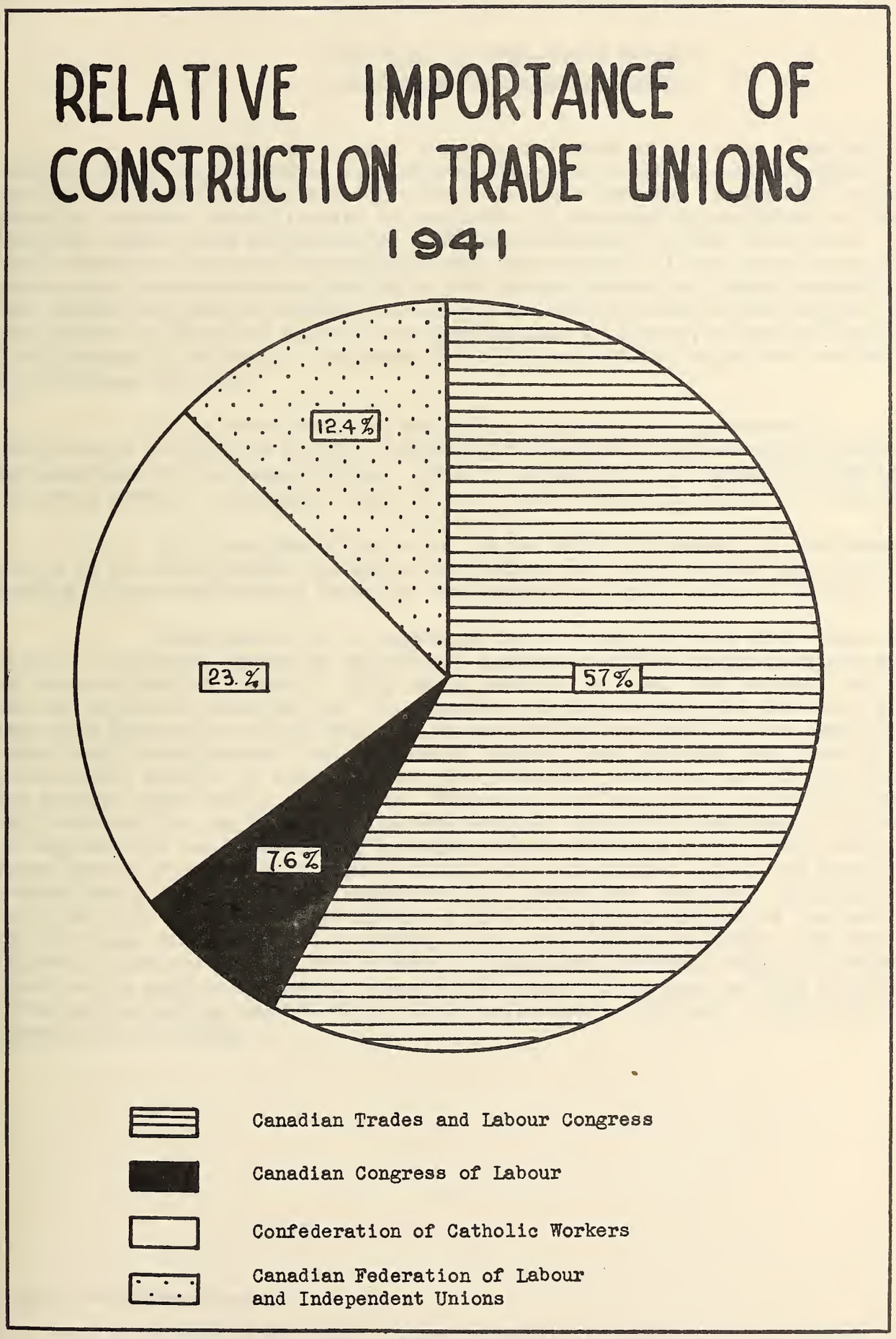

Chart showing the relative strength of the main trade unions among organized construction workers. Source: Special Compilation by the Department of Labour, March 1943.

According to preliminary figures available in the 1941 Census, there were about 183,000 wage-earners (skilled, semi-skilled and unskilled) reported to be working in the construction industry. Taking this figure as a basis, only 22 per cent of the total wage-earning group were members of construction trade unions.

Proportion of Trade Union Members Among Construction Craftsmen

The Trades and Labour Congress of Canada is the only organization restricting its membership to skilled men, the other organizations accepting semi-skilled and unskilled construction workers as their members. Among this latter group no separate classification is available of construction craftsmen on the one hand and semi-skilled and unskilled construction workers on the other hand. The total number of construction craftsmen who are members of trade unions consist of persons who organized under the Trades and Labour Congress of Canada numbering over 23,000 men plus an arbitrary allowance for skilled construction workers who are members of the other trade union organizations in Canada; a total of thirty five thousand is assumed to represent the total strength of organized construction craftsmen in 1941.

There were about one hundred and ninety thousand persons in construction occupations in 1941 (excluding contractors, builders, and construction craftsmen in the armed forces). Thus it appears that organized skilled construction workers represented about 18 per cent of the total number of craftsmen.

It is estimated that about 50 per cent of construction craftsmen worked in the construction industry. It follows that about 36 per cent craftsmen working in the construction industry were members of trade unions in 1941.(1)

Representatives of organized labour claim that the above percentages have to be adjusted upward by excluding a number of working proprietors who work in the construction industry. This group, working on their own account, mostly without employees, have not got the mentality of wage earners and therefore stay away from trade union organizations. It has proved very difficult to convince these small entrepreneurs that they could improve their working conditions if they would become members of trade unions. On the whole, these men work longer hours and receive lower hourly wage rates. Therefore, in the opinion of trade unions, only construction craftsmen who are wage earners should be considered. The number of wage earners can be estimated by using ratios available in the 1941 Census. There were 83 per cent wage earners and 17 per cent persons working on their own account among the gainfully occupied in the construction industry. By using the ratio of 83 to 17, there is obtained a figure of 79,000 construction craftsmen who were wage earners and were working in the construction industry. If this figure is compared with 30,000, assumed to represent the total number of organized construction craftsmen, then it appears that about 44 per cent of this working force were organized against 56 per cent unorganized. The above ratios can be summarized as follows:

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(1) This percentage gives only a rough indication because among the organized construction craftsmen there is included a small group of men who do not work in the construction industry.

TABLE VIII

ORGANIZED AND UNORGANIZED CONSTRUCTION CRAFTSMEN, 1941

Proportion	Per Cent
Organized construction craftsmen to total number	18
Organized construction craftsmen to craftsmen working in the construction industry	36
Organized construction craftsmen to wage earner-construction craftsmen working in the construction industry.	44

Although trade union organizations in this country have made great strides since the beginning of the century, particularly since the out-break of the present war, it appears from the above percentage that organized labour in construction does as yet not represent the majority of workers.

IV. STANDARDIZATION APPLIED TO THE BUILDING INDUSTRY.

The lack of co-ordination between the great number of industries and trades within the construction industry is discussed in the following section. Here, only one pre-requisite of the application of mass-production methods in building and construction is analysed: standardization, with special reference to building materials.

Agitation for rational building standards has been carried on in this country as well as in the United States and Great Britain, particularly since the conclusion of the last war. However, little has been done in this respect in Canada in the past two decades. Only the need to conserve materials and manpower during the present war has somewhat speeded up the development of standardization and simplified practice.

The fact that standardization cannot reach its greatest effectiveness until it is treated as a national problem has been recognized in all leading industrial countries. Shortly after the last war, national standardizing bodies were functioning in the following twenty-seven countries: Argentine, Australia, Belgium, Canada, China, C.S.R., Denmark, Finland, France, Germany, Great Britain, Greece, Hungary, Italy, Japan, Latvia, Netherlands, New Zealand, Norway, Poland, Roumania, Spain, South Africa, Sweden, U.S.A. and U.S.S.R.

Definition

Standardization can be described as the set-up by authority, custom or general consent, of rules or models by which extent, quantity, quality, value, performance and service may be gauged. In its broadest sense, standardization does not apply only to such matters as weights and measures and material objects; it embraces most fields of human activity.

Basically, standardization means the co-ordination of efforts for the purpose of achieving a better and more economical satisfaction of human needs by determing the components of the need, separating conforming from non-conforming elements, and then satisfying the conforming elements in a similar fashion. For example, every modern one-family house has at least one bathroom. Each bathroom has one bath tub. People would complain very much indeed if they would have to live in a house whose exterior is just like that of the neighbours, but only very few people would object to having a bath tub made of the same material and of the same standard size as their neighbours have. The desire of consumers to own different looking houses represents the non-conforming elements of the human need for shelter, while the standard size and standard quality bath tub represents one of the conforming elements, the aggregate of which makes up the need for proper housing accommodation.

According to the scale on which it is carried out, standardization may be classified roughly in four stages: 1. by individual companies, 2. group standards developed by associations and government agencies, 3 on a national scale, and 4. on an international scale.

The number of individuals and organizations interested in any particular piece of standardization work increases greatly from each of those stages to the next. Also the difficulties as well as the importance of standardization increase from stage to stage.

Generally two or more stages develop simultaneously. A piece of standardization work which has been carried out by a society or an association may have been put upon so sound a basis that it becomes essentially a national standard. The same is true even of the work of individual companies.

Every industrial firm is carrying on standardization of its own products and processes. Its competitive success largely depends upon the effectiveness and thoroughness with which it has studied and solved the problems involved.

Standardization is one of the essential factors of our age of mass production. It has an accepted place in our modern economy though it has not penetrated into all spheres as yet. The building and construction industry has a long way to go before it will benefit from the advantages of standardization which other industries are already enjoying.

Advantages of Standardization

Manufacturers standardize their products to gain the advantages and economies of mass production. The application of standardized design and production methods effects maximum interchangeability between parts entering into the finished product by securing constant uniformity in their size and other essential characteristics.

Standardization offers not only many advantages to manufacturers but also to distributors and consumers. The advantages may be summarized as follows:

(1) Standardization stabilizes production and employment, since it makes it safe for the manufacturer to accumulate stock during periods of slack orders, which he cannot safely do with an unstandardized product.

(2) It reduces selling cost. Possibilities of reduced costs are generally even greater in distribution than in production.

(3) It enables buyer and seller to speak the same language and makes it possible to compel competitive sellers to do likewise.

(4) In thus putting tenders on an easily comparable basis, it promotes fairness in competition, both in domestic and in foreign trade.

(5) It lowers unit costs to the public by making mass production possible, as has been so strikingly shown in the standardization of incandescent lamps and automobiles.

(6) By simplifying the carrying of stocks, it makes deliveries quicker and prices lower.

(7) It decreases litigation and other factors tending to disorganize industry, the burden of which ultimately falls upon the public.

(8) It eliminates indecision both in production and utilization - a prolific cause of inefficiency and waste.

(9) By concentrating on fewer lines, it enables more thought and energy to be put into designs, so that they will be more efficient and economical.

(10) By bringing out new facts in order to determine what is best and to secure agreement on moot questions, it acts as a powerful stimulus to research and development.

(11) It is one of the principal means of getting the results of research into actual use in the industries.

(12) It helps to eliminate practices which are merely the results of accident or tradition and which impede development (particularly significant for the building industry).

(13) By concentration on essentials and the consequent suppression of confusing elements intended merely for sales effect, it helps to base competition squarely upon efficiency in production and distribution and upon intrinsic merit of the product.

(14) Standardization is increasingly important for the maintenance and development of foreign trade.

(15) The efficiency of competing countries, increasing through national standardization programmes, is likely to stiffen competition between those countries.

(16) Joint effort in bringing about standardization within and between industries almost invariably leads to better understanding and to beneficial co-operation along other lines - a step toward the integration of industries. (1)

Applied to the building industry, standardization assists in lowering the construction costs without decreasing the quality, stability and conveniences of a modern building. Research work in the building field contributes to the development of standards of privacy, safety, convenience, occupancy, minimum size, etc. Mr. C. S. Ascher points to the experience that, for example, "a better understanding of the proper orientation of the house to the sum of its latitude may save as much as a new type of heating system". He concludes that true standardization applied to the building field would put into the hands of the imaginative designer "inexpensive tools with which to create a variety and rewarding living environment".(2)

Increased use of standardized building materials would not only benefit the industry and the consumer, but also the construction labour force. It has already been pointed out that the annual earnings of the construction workers were below those of the gainfully occupied person in the pre-war period, in spite of the comparatively "high" hourly wage rate. the main reason is that the wage earner in the construction industry loses more working weeks than the average working man. (3) Mr. J.L. Kingston, Secretary of the National Joint Conference Board in Ottawa, emphasizes the fact that standardization of building materials would reduce unemployment among building workers. (4) Many deadlocks in building operations which cause idleness or dismissal of workers would be avoided by using standardized building material. Very often material is not delivered on time, or if delivered, it fails to fit or is not the type ordered. This causes not only delay in building operations but also additional costs which are ultimately borne by the consumer. It means the constant shifting of working men from one unfinished job to another, and if delivery of materials is held up too long, it means dismissal.

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1. Source: "Mechanical Engineering", United States, August 1926.

2. C.S. Ascher: "Better Cities", National Resources Planning Board, Washington, April 1942, p. 16.

3. See Preliminary Report IV: "The Supply of Building and Construction Labour", Advisory Committee on Reconstruction, Ottawa, February 1943, p. 53.

4. In a study of "Methods for Increasing the Income of Construction Workers", Mr. Kingston points out that a more continuous employment of construction workers could be secured by proper and timely planning of construction projects in order to reduce seasonal unemployment and by increased use of standardized building materials.

Furthermore, cyclical unemployment of construction workers may be reduced because standardized building materials will allow reduction in construction costs. Thus, to quite some extent, an increase in the volume of production may be expected resulting in additional employment for construction workers (see Appendix IV).

Objections to Standardization

The term "standardization" applied to the building industry is unpopular with the layman because he usually thinks of a great number of blocks of identical houses with only the street numbers to distinguish one dwelling from another. If that were the only meaning of standardization in the house building industry, the objections of laymen would be understandable.

Fortunately, modern standardization applied to the building industry by no means attempts to force upon the consumer endless streets flanked by rows of monotonous, identical houses. It requires, however, a considerable amount of education to convice the public of the advantages which true standardization is going to bring them. We must abolish a notion that can be traced back to William Morris' assertion, in 1888, that "production by machinery necessarily results in utilitarian ugliness... a serious evil and degradation of human life" (1). This assertion has been disproved by actual machine production over and over again. In the building field, however, the idea still persists that standardization means nothing else but infinite repetition and monotony and must therefore be avoided at all costs.

The strong opposition to building standardization is based on a number of reasons:

(1) Misunderstanding of the term "standardization" and the various types of standardization. Sometimes standardization is mistaken for simplification. Education of the public could easily overcome objections based on the consumer's lack of knowledge of the true meaning of standardization.

(2) The traditional adherence to the old building methods which, in a way, still represent handicraft production. Objections come mainly from small contractors and builders and craftsmen who are afraid that standardization of design, process of assembly and building materials may mean reduced opportunity for them to earn their livelihood. This objection could be overcome by making clear that an improvement of building methods by the use of standardization would cause a reduction in building costs, thus creating an additional market for new structures and in that way create even more work than there was at the time when handicraft building methods were used.

(3) Sometimes, advocates of standardization claim that it represents a panacea for all the difficulties which the construction industry faces. This is an overstatement and harms the sound principles which underlie standardization. The inadequacy of the building industry cannot be blamed on the lack of standardization alone. As has been pointed out in Sections II and V, the problem of the construction industry is mainly one of organization, standardization in its various meanings representing only a small fraction of the problems which the industry faces.

(4) It is sometimes claimed that standardization means cessation of development. This is not in accordance with the meaning of the true standard which remains fixed for only so long as the factors which brought it into being remain in existence. If only one of the many factors contributing to standardization disappears, the standard has to be changed in accordance with

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(1) "Building's Post-War Pattern - Standardization", Architectural Forum, November 1941, Vol. 75, No. 5, p. 358.

development. For example, should the average height of the inhabitant increase, the standard size of bath tubs would have to be changed. Thus standardization undergoes a process of change with the alternation of human needs. Not only does it not mean cessation of development but it frequently stimulates development because of the specialized attention given to certain sizes or types of material used.

Simplification

Standardization should not be identified with simplification or simplified practice. Much that passes for standardization is merely simplification. Many objections raised against standardization arise out of the failure to make a proper distinction between these two terms. Simplification means the commercial elimination of an innecessary variety in sizes, dimensions, grades or qualities of common commodities. Simplification is merely a weeding out process by eliminating items, models or procedures which are no longer or never were really useful.

The chief purpose of simplification is to reduce the economic waste resulting from the production and distribution of too many varieties of this same general class of goods. It removes waste which is due to the over-diversification of commodities, unnecessarily large inventories, increased cost to carry them, slower turnover, idle investment and increased risks of obsolescence.

The advantage of simplification for the producer is increased production at lower costs, reduced carrying costs and smaller business risks. The consumer benefits from simplification through lowering prices, improvement in quality of product and in the service of supply.

Insofar as waste is removed, it is beneficial. But it does not call for redevelopment; it simply discards. For this reason it is not a coordinating force, and can be practiced by any organization independently of other organizations. Standardization, on the other hand, is impossible without collective agreement, and normally results in redevelopment and improvement of the product of service involved. Simplification may clear the way for standardization and standardization frequently results in simplification, but their objectives are quite different and should not be confused. (1)

The practical importance of simplification applied to construction materials can be seen from the following table which shows the great reduction in varieties of certain types of construction materials in the United States. Within the first decade since the conclusion of the last war it was possible to reduce the different types of construction materials by 71 percent.

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(1) "Building's Post-War Pattern - Standardization", Architectural Forum, November 1941, Vol. 75, No. 5, p. 355.

TABLE IX

SIMPLIFICATION APPLIED TO CONSTRUCTION MATERIALS
IN THE UNITED STATES (1)

1920 - 1930

Commodity	Varieties		
	Former Number	Present Number	Reduction Percent
Paving bricks	66	5	94
Asphalt	102	10	90
Steel reinforcing bars	40	11	72.5
Metal lath	125	24	81
Woven wire fence	552	69	87
Asbestos millboard	10	5	50
Eave trough and conductor pipe	21	16	24
Concrete building units	115	24	80
Sand lime brick	14	3	78.5
Roofing slate	98	48	51
Average reduction	-	-	71

Types of Standardization in the Building Field

1. Standardized Building Design

The editors of the Architectural Forum have made a survey of the opinions of architects, engineers, builders, industrial designers and government officials for the purpose of determining what, in the opinion of these experts, the effect of standardization has on design of buildings. In the following a summary of their findings is given.

> Just as real standardization is essentially a design process, good design is essentially the application of the principles of standardization to a specific task: an analysis of the basic objectives, or human needs to be satisfied, followed by the working-out of the best and easiest means of satisfying those needs. Exactly as standardization results in the codification and repetition of certain elementary forms and solutions because of their proven ability to meet particular needs especially well, design employs similar repetitive elements. The door, the window, the arch, the stair -- in fact all of the elements of building design are each examples of elementary design standards of this type, just as the various styles, in their own time and appropriate setting, are instances of design standardization on a more complex scale. The conscious desire for similarity and for repetition of particular design elements in order to achieve simplicity, arose long

(1) R.M. Hudson: "Standardization", The Encyclopaedia Britannica, New York, 1932, Vol. 21, p. 307.

SIMPLIFICATION OF CONSTRUCTION MATERIALS, UNITED STATES 1920-1930

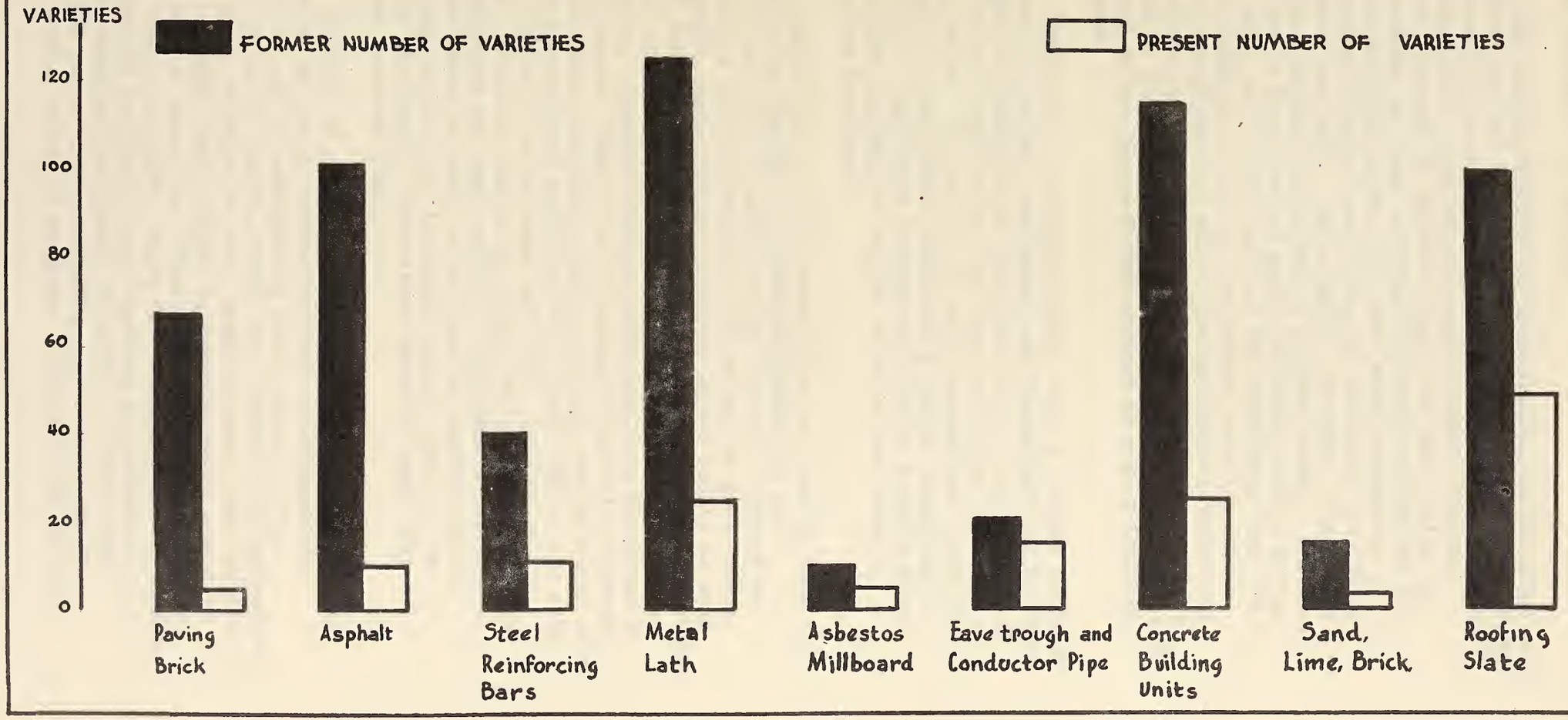

Chart showing the effect of simplification on construction materials in the United States (1920-1930). The reduction of varieties of commodities numbered between 24 percent and 94 percent of the number used before introduction of simplified practice. Source: R.M. Hudson, "Standardization", Encyclopedia Britannica, New York 1932, vol. 21, p.307.

before machine production was developed, at a time when such similiarity was sometimes difficult to achieve.

Real standardization of house design, on the other hand should stimulate and not retard the differentiation of house-types in accordance with actual need. It would almost certainly result in the development of plans offering approximately the same facilities but arranged in different ways for lots facing in various directions, in plans offering differing facilities for families with different needs, in a more exact adaptation of design to varying climatic conditions, in provision for the use of various materials with a given design, in more, rather than less, variation between the houses on a given street. And real standardization of house design would certainly require more, rather than less, work on the part of the architect: time for a thoroughgoing analysis of all of the factors entering into a given design; development of all of the appropriate variations of a given scheme to fill varying needs and situations; active participation in the design of most of the houses built for every income bracket rather than a field confined to a tiny fraction of those housed.

Consciously or unconsciously, many a leading architect works in exactly this way, developing and discarding new standard elements which are combined in different ways to meet differing needs, and unhesitatingly repeating those solutions which have proved their value. In fact, it is only through such repetition that the work of a particular architect acquires recognizable style, and only be agreement between the work of a whole school of designers that generalized styles -- which are actually standards -- are developed.

Another way in which architects can benefit from standardization is through a planned programme for the development of carefully-studied design elements, carried on both individually and collectively. There may be good reason why, for example, more than one bathroom layout should be used in the small house field, but there is certainly no justification for more than four or five such arrangements in a given class of construction. Standard designs could easily be developed in considerably greater detail than is normally possible, improved wherever improvement suggests itself, and then used over and over again to the advantage of architect and client alike. The same process is applicable to kitchens and other sections of the house. If a sufficient number of architects are able to agree on what constitutes an ideal series of bathrooms or kitchens, manufacturers should be only too willing to furnish special items of equipment (such as tailored counter tops) at the price usually charged for stock items which is lower than that for made to-order items.

Easiest of all, architects can further the idea of standardization by simply indicating their willingness to entertain it -- and by contributing their advice to the development of new standards. There is a widely held impression, especially among building material manufacturers, that architects are unable to adapt their designs to anything which cannot be hacked out with an axe, like a floor beam, at the site of the building. Despite resources which far exceed any at the command of the individual architect, manufacturers are reluctant to develop new standards that smack of design, for fear that architects may resent such proposals. As a result, many a good idea remains locked in corporate files for lack of an

encouraging word from the profession. (1)

One of the important features of economy in design is the standardization of space arrangement. The National Small Homes Demonstration Committee has made a start in this direction. This committee is composed of representatives of leading manufacturers and others under the sponsorship of the National Lumber Manufacturers Association. Its purpose is "to foster improved design and to promote local demonstration of economy in building and financing of small low-cost homes." After consideration of the various types of heating systems, bathroom fixtures, and kitchen facilities, a standard size for bathrooms, kitchens, and utility spaces was recommended for the design of homes costing $3,000 or less. The principal effect will be the influence on manufacturers of equipment to standardize their over-all dimensions to fit such spaces. The committee also promulgated a series of room arrangements so that the greatest economy in partitions, piping, and other materials might be obtained. The fact that a committee of manufacturers has taken the initiative in finding economies through design indicates the possibilities in that field and emphasizes the neglect by the architectural profession. (2)

That the use of such standardized design elements would not result in identical buildings has been proved many times over by all of the classical styles of architecture. To those who feel that it would restrict creative ability, proponents of standardization have a stock answer: the symphony orchestra. Symphonic music requires the coordinated teamwork of hundreds of specialists, timed to the split fraction of a second. Acceptance of a standard pitch and standard score does not prevent individual virtuosity, and a Toscanini is always free to superimpose his own conception of the music as still another type of standard. So with any standardization of basic elements: to the extent that they are made interchangeable, they can more easily be rearranged or revamped to form new design patterns wherever and whenever desired. (3)

2. Standardization of Dimensions

In recent years considerable efforts directed towards a dimensional coordination of building materials are noticeable in the United States. These efforts are based on the idea of the "modular" or unit system. This system advocates the use of certain units in building construction. It represents merely a step towards standardization of dimension, principally by using multiples of 4 inches or 4 feet in all dimensions. For example, hitherto doors and windows were used in all possible sizes. The usual sized window may vary between 12 and 72 inches. Architects, however, are not satisfied to prescribe only the size of windows in inches, but even go to the extreme of fractions of inches. Thus it will be realized what an immense number of different sized windows, window frames and doors have to be produced by manufacturers in order to meet the demands of the customers. There is no need for architects to go to such extremes. Individuality of design could be well preserved if sizes of windows could vary, say from 2 to 4 inches.

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(1) "Buildings Post-War Pattern - Standardization", Architectural Forum, November 1941, Vol. 75, No. 5, pp. 358-360.

(2) P.A. Stone & R.H. Denton: "Toward More Housing", monograph No. 8, Temporary National Economic Committee, Washington, 1941.

(3) "Buildings Post-War Pattern - Standardization", Architectural Forum, November 1941, Vol. 75, No. 5, p. 360.

Considerable research work is being carried out in the United States for the purpose of determining how the acceptance of a 4 inch modular system would affect the building industry. According to findings released by the Albert Farwell Bemis' Foundation of the Massachusetts Institute of Technology (an association particularly concerned with research work and the advancement of a modular system in the building industry) the savings in design and construction costs would be considerable if a modular system were introduced in the building field. Although the modular system has as yet not received general acceptance in the United States, it is seriously entertained by the American Standard Association and a number of other agencies interested in the progress of building and construction.

For the last three years the modular system has been the subject of investigation by a committee known as Project A62, sponsored jointly by the American Institute of Architects and the Producers' Council, Inc. This Committee represents more than 400 different trade associations, engineering societies, and other interested building organizations. This study has already resulted in an approved system of simplified brickwork which uses the 4 inch module to good advantage in solving the problems of structural fit with other masonry materials, like back-up tile and concrete block, and with existing stock sizes of framing lumber, wood windows and doors.

The Committee investigating dimensional coordination summed up its findings as follows:

"The advantages of the dimensional coordination of building materials and equipment apply to (1) the preparation of the building plans and assembly details, (2) the manufacture of materials and equipment, and (3) the site fabrication of the same into the complete building.

1. The coordination of the dimensions of building materials and equipment does not contemplate the standardization of building design.

As a matter of fact the coordinated dimensions of component parts will provide complete flexibility in planning the building layout, and a variety of dimensioned parts and equipment, available in "Stock Sizes", adequate to meet the requirements of utility and appearance. Furthermore, the preparation of detail drawings will be expedited.

2. Dimensional coordination of individual parts will eliminate unnecessary intermediate dimensions in determining the number of "Stock Sizes" for individual materials and items of equipment while it will encourage the use of a limited, but adequate, number of stock sizes, thus reducing the cost of special details, custom manufacturing and the maintenance of slow moving stocks of an unnecessary variety of materials and equipment serving similar uses.

3. The application of dimensional coordination to such materials as pre-formed clay and concrete products, and doors and windows will avoid the cutting and fitting usually required in wall construction where these materials are used.

Dimensional coordination of materials does not preclude the use of conventional methods of cutting and fitting, if, for any reason, the requirements of design call for materials to which the principles of dimensional coordination have not been applied.

It will be obvious that the more completely the principles of dimensional coordination are applied to the component parts of structures as a whole, the greater will be the advantages resulting from simplification in detailing and manufacture, speed in erection, and reduction in the cost of

construction. To insure the maximum degree of these advantages, the scope of ASA Project A62 includes the coordination of building plans and details with the coordination of building materials.

This contemplates a basis of coordination applicable to all building materials whose physical properties permit a pre-determination of dimensions, and to many items of equipment built into or permanently fitted to the building structure." (1)

The virtues of the 4 inch module in traditional planning and construction can hardly be denied. Its multiples neatly encompass bricks and 2x4's, 16 inch stud spacings and 4 foot wallboard widths. It is a small enough size increment for doors and windows, yet large enough to eliminate unneeded variety. Together with standardized assembly details, which Project A62 is rapidly developing, it offers much in convenience to the designer, economy to the builder, and systematic standardization to the material manufacturer. But like all standards, it is not universal in scope. Complete dimensional coordination as practiced by the modern designer must also take into account larger units where these are important from the design standpoint, must allow for new design developments (project recommendations, for example, so far make no adequate provision for such items as window mullions which are also part of an articulated frame, for panel construction, for curvilinear forms). Nor must the 4 inch module be regarded as an eternally fixed and product; rather, it must be considered simply a good beginning and foundation for further progress as time goes on.(2)

3. Standardization of Quality

A great diversity of materials are used in the completion of construction projects. If those who prescribe the standard of the building and the quality of the material to be used can be assured of standard quality, their work would be a great deal easier and would provide a guarantee of quality to the ultimate consumer. The use of certificates and labels issued by standard associations in Great Britain, the United States and Canada have created a great sense of confidence among consumers as to the quality of the commodities they are buying. Hitherto, very little has been done in Canada to include building materials in the group of certified commodities. In the United States, however, a great number of building materials are sold on a guarantee label basis, including shingles, lumber, Portland cement, gypsum, lime, paint, paper, linoleum, piping, wall boards.

The present war has caused a reduction in the types of building materials used. For the purpose of conserving material, there are used in Canada, for example, only two types of bath tubs whereas before the war there were more than twenty. It is by no means suggested that after the war only two types of bath tubs should be used when there is demand for a greater variety. However, it may be desirable to have manufacturing industry, architects and builders, concentrate on a few types of bath tubs which, because of greater demand, could be produced at lower costs. The prospective buyer of moderate means will then be able to acquire a new house at lower cost than before the war and still be assured of good quality. The buyer who is not satisfied with a standard type of bath tub would be at liberty to buy any fancy design he desires. Naturally, he would have to pay a higher price for it.

Up to the present time, the diversity of building materials and fixtures used, has made it impossible for the man with a modest income to acquire a house fitted with standard facilities. Since builders and architects were only catering to persons who could afford to buy an expensive house, built by the old

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(1) Modular Service Association, 110 Arlington Street, Boston, Massachusetts: "Proposed American Standard Basis for the Coordination of Dimensions of Building Materials and Equipment", May 1943, pp. 8-9.

(2) Architectural Forum, Nov. 1941, p. 361.

handicraft method, a great proportion of prospective house buyers was eliminated from the market right at the beginning.

Standardization in the quality of building materials is one of the important factors which could contribute to a lowering of costs. Thus the consumer himself ultimately benefits since he is offered a good quality house at a price which he can afford to pay.

4. Standardization of Assembly

Standardization of assembly is a method which makes possible a more economical construction of projects by the use of standardized parts.

According to the findings of the editors of the Architectural Forum standardized building parts which are interchangeable have rendered the job of architects and other specification writers a great deal easier, while at the same time increasing the range of choice. A number of industries have already set up standards under regular procedure prescribed by the American Standard Association and have achieved excellent results.

Standardization of assembly has been carried very far by one American firm, the Homasote Company of Trenton, New Jersey. This firm has put the modular system to practical use as a basis for semi-prefabricated construction. The Homasote Company equips local lumber dealers with the proper gigs, tables, design systems, and methods of operation to enable the dealers to precut many parts of a house built with regular materials including Homasote for insulation, the prefabrication of complete wall and floor sections which are erected in the field. Since they are designed on a modular plan they are applicable to any ordinary type of single family residence built of wood frame, brick, veneer or stucco. (1)

The Homasote Company claims that their "precision built homes" can be produced considerably cheaper than the house erected in the old handicraft method without reducing the quality of the materials used or enforcing the same design upon all customers. The Company is now preparing calculations in the form of statistical tables to show the savings which can be achieved by the practical application of standardized methods of assembly and the use of standardized building parts.(2)

Standardization Agencies in the United States (3)

1. Private Agencies

A considerable number of private agencies are concerned with standardization in the United States. The most outstanding organization is the American Standard Association which is a type of clearing house or co-ordinating agency for the purpose of bringing about systematic participation by and co-operation of the many organizations and associations working on problems of standardization. This agency includes the major engineering societies and a considerable number of national industrial associations among its members.

The functions of the American Standards Association are described as follows:

"It serves as a clearing house through which industrial, technical

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(1) F.V. Wilson, Jr.: "Tomorrow's Homes", published by the Homasote Company, Trenton, 1939.

(2) See statement by R.I. Davison, at the hearings before the Temporary National Economic Committee, part II, p. 5337.

(3) For standardization in Great Britain see Appendix V.

and governmental groups develop and coordinate their standardization programmes in the interests of economy--looking toward the development of a single, consistent set of national standards. It also acts as the authoritative channel for international cooperation in standardization work.

The broad range of projects includes: dimensional standards to allow for interchangeability of supplies or to secure the inter-working of parts or of interrelated apparatur; specifications for materials and methods of test; definitions of technical terms used in industry; industrial safety codes to make possible uniform requirements in safety devices for machines and other equipment in the fields of both public and industrial safety; industrial health codes for the prevention of occupational diseases; the development of a national building code; specifications for consumer goods sold in retail trade.

The American Standards Association was organized in 1918 as the American Engineering Standards Committee, by five national engineering societies. Its purpose was to serve as a clearing house for their standardization activities. As the work of the Committee grew and its activities extended into new industrial fields, it became necessary to reorganize the Committee along broader, more flexible lines to meet the growing need and demand for American Standards. In 1928 the name was changed to the American Standards Association.

Today the membership of the Association includes 75 national organizations and more than 2,000 companies. Membership is open to any industrial, commercial, technical, or governmental group concerned with standardization work.

With the cooperation of the National Bureau of Standards the Association is carrying forward on an enlarged scale the development of a national building code, formerly undertaken by the Department of Commerce. There is effective cooperation between the Association and state highway, utility, and traffic administrations. The government is encouraging the extension of the work of the Association and the utilization of its services by industry.

The American Standards Association is a member of the International Standards Association through which the national standardizing bodies of the world carry on their general cooperative activities. Through these and other means the Association makes available to American industry direct and authoritative contact with standardization developments in other lands" (1)

2. Government Agencies

The United States Government is greatly interested in industrial standardization and co-operates with private agencies in encouraging its advancement.

The government is interested in standardization first, as a purchaser of materials and apparatus and secondly, through its services and research facilities in innumerable standardization problems. Although a number of departments are interested in standardization, it is the particular concern of one central agency in the United States, the National Bureau of Standards, working under the Department of Commerce.

Its functions are described as follows: "the custody of the standards; the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions with the standards adopted or recognized by the Government; the construction, when necessary, of standards, their multiples and subdivisions, the testing and calibration of standard measuring apparatus; the solution of problems which arise in connection with standards; the determination of physical constants and the properties of materials, when such data are of great importance to scientific or manufacturing interests and are not to be obtained of sufficient accuracy

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(1) American Standards Year Book 1938, New York, p. 3.

elsewhere." (1)

Commercial standards are also included among the functions of the National Bureau of Standards. With regard to commercial standards it is of importance to note that its service is mainly promotional in character and based on voluntary acceptance of standards. The Bureau helps to work out such standards and adds periodical audits of aherence, also operating with the United States Bureau of Foreign and Domestic Commerce in applying the standards to foreign commerce.

The National Bureau of Standards has taken a particular interest in standardization in building and housing. Since the volume of construction carried on in the United States is considerable (varying between 3 to 12 billion dollars annually depending on the phase of the business cycle (2), it has been recognized that great savings could be achieved by applying the principles of standardization to this industry.

Co-operating with the National Bureau of Standards is the Advisory Building Code Committee which has been most active and influential in the building field. More than half of the construction work carried out in the United States is performed under conditions prescribed by local building codes and each of the committee's reports gives concise recommendations suitable for inclusion in such codes.

The Bureau's work relating to the field of building and construction undertaken in recent years can be summarized as follows:

1. Factual information is being developed with regard to the actual performance of building materials by an agency which has no commercial interest in any material or group of materials and which is not prejudiced for or against any material.

2. The information developed is based on objective tests which may be repeated by any competent engineer. The development of these objective methods of measurement is essential to progress in housing.

3. The way to the use of performance standards in building codes is being opened. The substitution of performance standards for descriptions of particular types of construction will accelerate the introduction of better and cheaper methods.

4. Laboratory studies of failures point the way to methods of successful use of building materials, and demonstrate that many failures are due to improper application rather than to any inherent defect in the materials themselves. There are no perfect materials suitable for all applications.

Many of the agencies have found it practicable to make decisions on the basis of objective tests by the Bureau and other pertinent data rather than on individual experience, perhaps satisfactory in some cases, but not necessarily of general application.

Some specific examples of results of the building materials research programme which lead to a reduction of cost are set forth herewith:

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(1) National Bureau of Standards: "Functions and Activities", United States Department of Commerce, Washington, June 1939, p. 1.

(2) P.A. Stone & R.H. Denton: "Toward More Housing", Monograph No. 8, Temporary National Economic Committee, Washington, 1941, p. XV.

(a) Methods have been developed for the successful application of plaster on fiber insulating lath. Thus, a single material serves as plaster base and as thermal insulation and it is possible to obtain a specific degree of insulation at lower cost. The research also indicated that the plaster must be a strong plaster and at least one-half inch thick if cracking of the plaster is to be avoided.

(b) Structural tests have shown the possibilities of using fiber insulating boards as sheating. Here again one material serves two functions and the cost of obtaining a specified thermal insulation is reduced.

(c) In co-operation with various manufacturers of masonry materials, methods of constructing masonry walls of less material and of less costly materials, such as cinder block, concrete block, tile, etc., either singly or in combination, have been investigated. It has been determined that 8-inch walls may often be substituted for 12-inch walls and that the cavity type of construction offers opportunity for obtaining a given performance as to structural strength and resistance to rain penetration at lower cost.

(d) The results of studies of mortars in relation to building walls which prevent the penetration of rain have been incorporated in the specifications for new housing projects. The maintenance and repair costs of these structures may be expected to be considerably reduced.

(e) The results of research have prevented the unnecessary expenditure of money on plasticizers and other admixtures in mortars.

(f) Accelerated aging tests on wall boards give the basis for a specification for obtaining a material of longer life at the same cost.

(g) In many localities there are legal requirements as to fire resistance. Research has shown how to secure a given fire resistance at lower cost. A method recently developed is the use of incombustible fillings. In a recent housing project, the required resistance was obtained by filling the partition around a stair enclosed with scrap brick, mortar, and plaster. In other cases partition walls filled with mineral wool and plastered with gypsum plaster could be used instead of tile partitions. By the use of incombustible fillings, the field of application of the less-expensive wooden construction can be extended.

(h) Studies of paints by practical performance tests make possible the avoidance of unnecessarily expensive materials. The relative merits of various types of paints and pre-treatments for sheet metal, both galvanized and ungalvanized, have been determined. The work on cement-water paints is expected to lead to formulae by which any contractor may mix satisfactory paint on the job from relatively inexpensive materials. Research has already shown that these paints properly applied are a reasonably satisfactory means of water-proofing leaky masonry walls.

(i) Formulae for satisfactory non-proprietary calking compounds have been developed.

(j) Tests of heating equipment enabled a satisfactory evaluation of costs of the equipment. In recent tests, one class of devices was found to be considerably overrated so that the bids including that type did not correspond to the same actual heating capacity as bids on other types. An oil-burning combination domestic hot-water supply and hot-water heating system was found satisfactory for small houses in a recent project.

(k) The use of 3-inch soil stacks in the plumbing systems of small houses rather than 4-inch stacks has been found entirely satisfactory. Simplified piping systems have been developed for small houses and apartment houses. The adequacy of various methods of protection against the back flow of polluted water into the water supply system has been studied. All contribute to cost reduction, but major cost reductions in this field are to be expected only with prefabricated equipment.

5. The Bureau co-operates with industry to eliminate superfluous sizes and varieties of building materials, avoiding waste and reducing costs. Recent recommendations cover concrete building units, lumber and roofing ternes.

6. The Bureau assists industry in the development and establishment of commercial standards of quality for building materials. Recent work has covered stock doors, windows and frames, plywood, and hardwood paneling, trim and molding.

7. The Bureau takes an active part in building code revision and modernization. It lends its influence toward the use of performance requirements and toward setting the requirements only as high as the safety and health of the public require. Placing the requirements on a performance basis makes possible the use of lower cost methods of giving the performance as soon as they are developed. (1)

It is commonly accepted that the results achieved by the National Bureau of Standards have been beneficial to all concerned, architects, builders, material manufacturers, government agencies and the public as a whole.

Standardization in Canada

1. Canadian Engineering Standards Association

The Canadian Engineering Standards Association (C.E.S.A.) is a private agency, established in 1919 by a number of industries for service to producers and consumers alike. The organization of the association is similar to that of the British Engineering Standards Association which was established in 1901 as a first national standardizing body. Among the objects as enumerated in the charter of the Canadian Engineering Standards Association are:

1. To co-ordinate the efforts of producers and consumers in matters of the improvement and standardization of engineering products.

2. To promote the general adoption of engineering standards and to revise and amend such standards when necessary.

3. To register, use and protect distinctive markets or products which are in accordance with standards.

4. To make arrangements with governments, or other authorities, to obtain from them privileges or concessions conducive to the objects of the association.

5. To appoint overseas representatives of the association, and

6. To do all such other things as the association may think conducive to the attainment of its objective.

The C.E.S.A. is managed by a main committee composed of not more than 100 members. On this committee are represented the Canadian universities, professional bodies, industrial associations, government departments (including the National Research Council), public utilities, the Canadian Electric Association and the Canadian Manufacturers Association.

The C.E.S.A. is concerned with standardization and simplification. Its work is based on principles of voluntary adhesion to requirements prescribed by the C.E.S.A. Before work on standardization of any specific design or commodity is initiated, the necessity for a standardized product or process has to be

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(1) National Bureau of Standards: "Functions and Activities", United States Department of Commerce, Washington, June 1939, pp. 18-23.

established by investigation and consultation with producer and consumer interests. Once the interest in the establishment of a standard has been confirmed , an appropriate working committee is organized, called upon to explore the subject and prepare drafts of the proposed standards. The draft report on the proposed standard passes the executive committee, finally reaching the main committee for formal approval. After approval the new C.E.S.A. standards are published.

During the past two decades the C.E.S.A. has been mainly concerned with standardization and simplification in the following fields: Civil, mechanical and electrical engineering, automotive and railway work, ferrous metals, steel constructions and air-raid precautions. With the exception of screws and bolts covered under mechanical engineering and electrical fixtures covered under electrical engineering, no standards or simplified practice have been introduced in the field of building materials. For some time standardization and simplification of building materials have been under consideration by the C.E.S.A. but no information as to the progress made has been published as yet. The standard specifications for building materials, at present under consideration by the C.E.S.A., deal mainly with plaster and gypsum, brick, tiles and concrete masonry units. No standardization of lumber products, of particular importance in this country because of the great use of lumber in house construction, is contemplated at present.

There is no doubt that the C.E.S.A. has done commendable service and considerable spade work in the field of standardization and simplification. In the main, the activity of the C.E.S.A. has depended on the initiative taken by the industries concerned. When an industry was alive to the advantages of standardization, such as, for example, heavy steel industries or manufacturers of electrical appliances, considerable work was done in these particular fields. On the other hand, backward industries such as the construction industry have not taken the initiative in making use of the services of the C.E.S.A. This is one of the main reasons why practically nothing has been done to standardize or simplify building materials although there exists a basic need for it. The answer to this undesirable state of affairs is simply this: if the construction and building industry is not able to make use of the facilities at its disposal to achieve standardization and simplification of materials and processes, then the government will have to step in. Lethargy in an industry cannot be allowed if it harms a community as a whole. The need for low-cost housing is very great. We cannot allow the lack of initiative on the part of the construction industry in the field of standardization and simplification hamper our efforts to provide low-cost housing for the hundred thousands of Canadians who require it. Colonel W. R. McCaffrey, the Secretary of the C.E.S.A., pointed out recently that the "industry has the option of directing development in the field of standardization, or the alternative of having it placed under government control. One or the other is inevitable". (1)

2. Government and Standardization

There does not exist a Bureau of Standards in Canada similar to the National Bureau of Standards in the United States.

A considerable number of government departments are concerned with problems of standardization. Since there does not exist a central agency, there does not exist a uniform policy of dealing with problems of standardization or the encouragement of other agencies to advance development of standardization. Amongst the government departments concerned with problems of standardization and simplification are:

(a) The Wartime Prices and Trade Board, interested in maintaining the level of prices of commodities by cutting out frills, and applying certain principles of simplification and standardization, (b) the Department of Munitions

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(1) Canadian Engineering Standards Association, Quarterly Bulletin, Dec. 31, 1942, Vol. 16, No. 4, p. 1.

and Supply, interested in the conservation of materials and the reduction of labour employed in the production of commodities, (c) the National Research Council, which is carrying on research and testing, (d) the Department of Public Works, which acts as a purchaser for numerous supplies required by the government and prescribes certain standards in quality, design and dimensions, and also carries out testing of various kinds of materials, (e) the Department of Mines and Resources, which also carries out certain kinds of research and testing, and (f) the Housing Administration of the Department of Finance, which is concerned with the maintenance of minimum standards of buildings erected with assistance under the National Housing Act 1938.

The establishment of standard specifications and the application of simplified practice has become an essential feature of Canada's wartime industrial expansion. As Colonel McCaffrey has said, "the need for such development has impressed itself more and more upon industry in general and on war industry in particular. Unfortunately there have existed diverse opinions as to the best manner in which the principles of standardization should be applied under war conditions, and the urgency of establishing, quickly, compromise schedules, procedures and practices, as well as acceptable substitute materials and compounds, has frequently resulted in a lack of co-ordination and in duplication of effort. This is probably to be expected during war emergencies, but might, with forethought, easily be avoided, and obviously emphasizes the fact that a bureau of standardization, covering the full scope of national requirements, is an essential adjunct to a national organization directing industrial production on a large scale ... The lessons of the war may, and probably will, be intensively applied in the post-war period, in so far as they concern correlation of the most suitable materials with the greatest degree of efficiency in manufacturing practice". (1)

This report in particular is concerned with standardization and simplification of building materials and processes which would contribute to a reduction of costs in the construction of modern buildings. It may well be that existing facilities in this country suffice to meet the requirements for standardization and simplification of commodities of other industries than the construction industry.

One thing however is clear. The construction industry itself has done nothing in the past twenty years to further standardization and simplification of materials and processes, which are essential factors in determining the costs and the quality of its products. Because of the lack of initiative on the part of the industry the Canadian Standards Association has not been in the position to make any contribution of importance to standardization and simplification in the building field. It may well be that the construction industry will sooner or later awake from its lothargy and will try to make good the omissions of the past two decades.

A sound post-war economic policy cannot leave the matter to chance. If standardization of building materials is an essential requirement of a well planned post-war housing policy, then facilities have to be created to achieve this goal. If the industry itself fails to recognize the needs, then the government has to take the initiative.

A number of government departments have been concerned with individual phases of standardization and simplification of building materials. It appears essential to co-ordinate all these efforts and empower one agency, either one that exists already or a newly created one, to take charge of the numerous problems involved in introducing and encouraging standardization and simplification of building materials. In practice, this means the creation of a Dominion Bureau of Standards, with functions similar to that of the National Bureau of Standards in the United States but with due consideration to specific requirements in Canada.

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(1) Ibid.

The C.E.S.A. recognizes the fact that it has not made the progress in standardization and simplification that desirable and possible for the Canadian economy. The reason is simply that certain industries have not found incentives enough to use standardized materials and processes which could be developed by such bodies as the C.E.S.A. If this state of affairs continues, standardization and simplification will never play an important role in the field of building and construction in Canada.

It is therefore necessary that an independent agency, take the initiative and encourage standardization. The proposed Dominion Bureau of Standards would primarily be concerned with the standardization and simplification of building materials and processes. Thus, its activity would cover a field which has hardly been touched by the C.E.S.A. The Bureau would further co-ordinate the efforts of those government departments which are already interested in standardization. As the Dominion Bureau of Standards developes, it may include industrial standards other than building standards. This enlargement of the task of the Dominion Bureau of Standards would, however, be desirable only if it does not mean a repetition of the work already being carried out by the C.E.S.A.

Further consultation with private industry and government departments may be advisable before a Dominion Bureau of Standards is created. If so, it should be undertaken at the earliest possible moment so that the Bureau may be set up and functioning before the conclusion of the war.

Its establishment is a matter of urgency if it is to make the significant contribution which is essential to the success of a post-war building programme.

V. THE NEED FOR AN EFFICIENT INTEGRATION OF THE CONSTRUCTION INDUSTRY AFTER THE WAR.

The lack of a central organization covering contractors and builders in Canada is but one of the numerous problems relating to the field of organization in the construction industry. This industry cannot function properly unless it is well organized. This means that not only contractors and builders should be united by their common interests but arrangements should also be considered to ensure that the relationship between the essential stages of production and consumption follow a simple, clearly defined line. This requires a minimum of waste and the carrying out of each step with maximum efficiency. We speak of an "integrated" industry when the relationship of the individual phases within one industry are clearly defined and allow smooth operation of all wheels in a rather complicated mechanism - beginning with the exploitation of raw materials and ending with the service provided for the customer and the liquidation of the consumer good when obsolete.

Backwardness of Construction Industry

It has been repeatedly stressed by competent authorities that the construction industry has not made the spectacular progress that other industries have made since 1918. The noted economists, Alvin H. Hansen and Guy Greer go even further by saying, "it is a matter of common knowledge that residential construction is our most backward industry. In an age of mass production and assembly lines, it remains today, with a few noteworthy exceptions, a small scaled handicraft business which hardly deserves to be called an industry at all. It is made up of a large number of contractors, sub-contractors, material dealers, trade unions, and so on". (1)

Dr. W. C. Clark, the Deputy Minister of Finance, in a discussion of the role of the building industry in Canada emphasized the backwardness of the industry while giving due consideration to some of its accomplishments. Dr. Clark said:

"I have a tremendous admiration for some branches of the construction industry and for many of the industry's achievements. To my mind, there is no more complex or more difficult type of production than, say, the planning and building of a modern skyscraper or the erection of that great bridge across the Golden Gate in San Francisco Bay. These products of the construction industry represent to me 'the tipmost top of the topmost' peak in the utilization of modern technology and the display of modern entrepreneurial genius. Compared with them the repetitive processes of the large-scale manufacturing plant are mere child's play. Nothing, moreover, can be a more exquisite expression of the craftman's art than a completed house which is truly beautiful and truly adapted to the function of providing a home for the human family. But beautiful houses are relatively rare and few of them show the results of the application of business genius and advanced technology. Making due qualification for the fine contribution of many small builders working under great handicaps, the truth of the matter is that the ablest and most responsible elements in the construction industry have not devoted their attention to the building of houses. They have spurned a business which appeared to be turning out a handmade product catering to the particular idiosyncracies of a few individuals in the higher-income groups. They have overlooked the possibilities inherent in applying organizing and promotive ability, large-scale methods, adequate financial resources and modern science, to the task of providing decent and economical shelter for families in the lower and middle income groups. This task has been left to the smaller and sometimes to the less responsible elements in the industry who are confronted with difficulties which, as we shall see, are almost insurmountable and the results are - what we see around us on every hand. Even for the best brains in the industry the difficulties will, I know, be enormously great but the colossal possibilities of the market should make the rewards commensurate with the effort expended. Few

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(1) Alvin H. Hansen and Guy Greer. "Urban Re-Development and Housing", National Planning Association, Washington, December 10, 1941, p. 14.

needs of the human being are more vital than housing and yet the mass of the people are inadequately housed, provided with shelter accommodation far below the standard, in quantity and quality, which capitalistic industry is supplying them in every other important field.

"Surely this constitutes a powerful and immediate challenge to the construction industry. It is a challenge to make the house-building business as efficient as that rugged young interloper, the automobile industry, which is taking an ever-increasing share of the consumer's dollar for a social purpose much less important than is housing. In effect, the public is saying to the house-building industry: either you must re-orient the whole business of building houses, introduce a greater measure of organization, efficiency, standardization and constructive salesmanship, improve the quality of your product, restore the buyer's confidence in that product, and generally endeavour to give 100 cents worth of value for a dollar price of housing, or you must be content to see your industry securing a steadily decreasing share of the consumer's dollar and suffering as a consequence from continuing stagnation, chaotic conditions, public illwill and possibly increasing interference from public bodies. I for one believe that the industry will gradually and increasingly respond to that challenge. (1)

Complexity of Construction Operations

In spite of their diversity the problems which relate to the role of the construction industry - after the war can, to a great extent, be grouped under one heading: Organization.

The editors of the Architectural Forum quite rightly emphasized that "until the question of the re-organization of the building industry along modern, integrated lines has been faced, improvements in the methods of fabrication and design will be only partially effective." Postwar building can only go on a mass-production basis when building becomes an integrated industry. ... Most manufacturing industries achieved integration in the decades between World Wars I and II. Building must catch up quickly, if it is to realize its true importance in the next period of the peace." (2)

From what has been said above one thing becomes clear - whether or not the construction industry will be able to fulfill its obligations after the war as a producer of very badly needed durable consumer goods and as a great field of direct and indirect employment will depend on an improvement in the relationship among all those who contribute to the completion and liquidation of its products. The following industries contribute their share to the completion and maintenance of a satisfactory construction product:

(a) Industries producing raw material required for building and construction.

(b) The industries which fabricate the raw material into equipment, parts and building material.

(c) The transportation industry which brings the raw material to the factories and the equipment, parts and other building material to the site.

(d) The professional men such as architects, engineers, etc., who prepare the plans for construction projects and carry out a great deal of supervisory work.

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(1) Dr. W. Clark: "Housing", an address made to the Convention of the Union of Nova Scotia municipalities, August 1937.

(2) The Architectural Forum: "Building's Postwar Pattern", New York, October 1942, Volume 77, No. 4, pp. 74 and 75.

(e) The contractors who undertake the assembly of the material and workers required for the purpose of completing a construction project.

(f) Wholesale and retail business with its hierarchy of sales agencies which distributes the equipment, parts and other building material required from the factory to the consumer or his representative, the contractor.

(g) The financial institutions which provide the funds required to bridge the gap between raw material production and the ultimate consumer.

(h) Construction tradesmen who keep buildings and other structures in serviceable condition.

The Present State of Affairs (1)

While exploitation of raw materials and fabrication of parts has reached a comparatively advanced stage of organization, the construction industry proper offers a rather backward picture. The diagram in Figure VI gives the organizational picture of all industries and professions contributing to the final product of construction. Insofar as possible, this diagram mirrors, from the consumer's point of view, the complexity and confusion which characterized the set-up of the construction industry in pre-war days. At the top, within the rectangle designated "area of integration," are the highly efficient, mass-production enterprises which supply essential processed materials: lumber, cement, brick, millwork, equipment and so on. Internally, these industries have been reorganized along modern lines, especially in the last two decades. They employ straight-line production methods, automatic machinery, and all the devices of science to produce the best possible building products at the lowest possible costs. But, between this area and the ultimate consumer lies a no-man's-land occupied by dealers, contractors, builders, architects, realtors, building finance organizations and construction tradesmen, to any one of which the consumer in search of housing is "free" to apply. Furthermore, there are also all sorts of cross connections in every conceivable direction between realtor and builder, builder and architect, consumer and manufacturer.

The most glaring flaw in this arrangement is that it provides so many alternative paths for the flow of goods and services, and inevitably results in duplication of effort. This is not all--there are other and equally important shortcomings. A number of the essential stages of the production - consumption process are out of sequence and one, namely liquidation, is missing altogether. The various parts and material manufacturers are each required to maintain their own apparatus for distribution and also, since no one else has the clear-cut responsibility, their own servicing organizations as well. This means, in effect, that many of the thousands of parts which make up the final product (building or other structure) must be sold virtually at retail, and burdens the product with excessive distribution costs and duplicated profits. (2)

Construction Industry and Consumers

The relation of the construction industry to the consumer has not always been a happy one. Very seldom a layman can say whether the house he has had built by a contractor is worth the money he paid. A number of speculative builders have entered into the field of residential construction and have

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(1) Ibid., pp. 70-81. The editors of the Architectural Forum have undertaken a survey of opinions as to the desirability and practicability of making the construction industry an "integrated" industry after the war. The views expressed in this survey are summarized here.

(2) Ibid., p. 77.

FIGURE VI

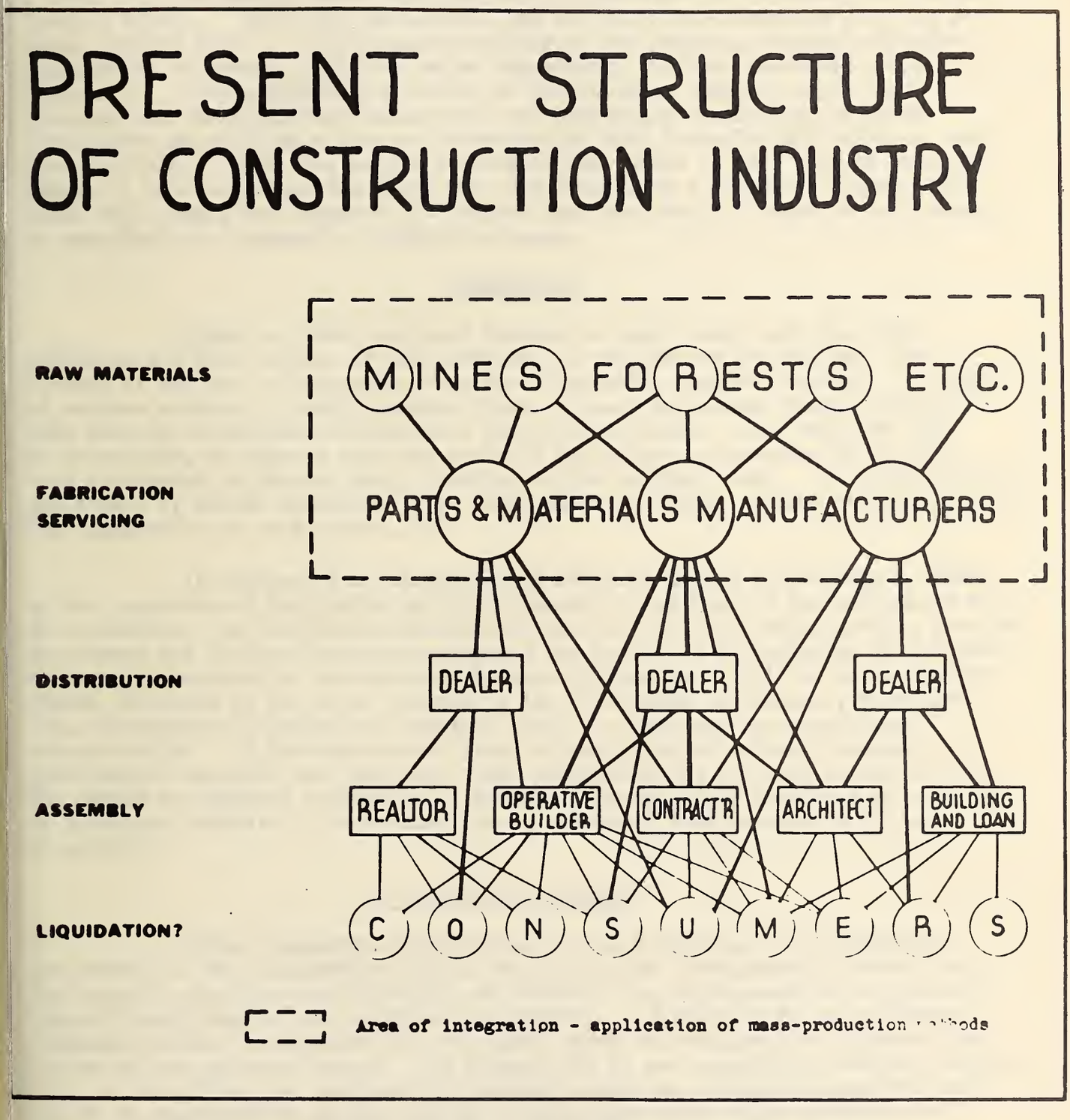

Chart showing that at present only a small section of industries contributing to the final construction project use efficient mass-production methods. Source: Architectural Forum, New York, October 1942.

FIGURE VI

Chart showing that at present only a small section of industries contributing to the final construction project use efficient mass-production methods. Source: Architectural Forum, New York, October 1942.

endeavoured to build houses as cheaply as possible. The result was disappointment on the part of the consumer and blame for the construction industry. On the other hand, consumers have not always been familiar with the difficulties which a contractor, especially the small man, experiences and have tried to drive a hard bargain. The result has been the erection of buildings which are below a desirable standard.

What is required is a competent organization not only able to build a house at a reasonable price but also able to convince the consumer that he is treated fairly. Mr. H. S. Buttenheim, the Editor of the "American City" in New York, pointed that . "intelligent selling of its product, through effective stimulation of demand, will be a major opportunity for the modernized building industry." Some responsible elements in the building industry claim that families will be adequately housed when the infinitely complicated problems encountered in building a home are co-ordinated with technological skill by one responsibility. Thus the complete house of the future is more than an excellent house; it is a technique developed and administered by a competent organization which will assure the consumer of a square deal and create a sense of confidence, so essential for successful building business.

Liquidation

Slums in cities and poor housing in rural areas have come into existence not only because of the inability to pay for new housing but also because of the lack of adequate means for liquidating obsolete houses. A number of sources comment: When a customer buys a house, he becomes imbued with the idea that he is entitled to realize a fantastic fortune. If a customer buys an automobile, he expects that the car will depreciate and eventually he will have to dispose of it at a small fraction of the original cost. It appears that a great deal of public education is in order to bring about a proper attitude toward the liquidation of real estate. (1)

It appears that liquidation of obsolete houses is not only a matter of the education of the public but also a social obligation of the Government to its citizens. If citizens themselves are not able to take proper action, then the Government has to step in and to safeguard the health of the citizens by measures assuring the removal of obsolete and unsanitary housing. This is supported by a recent statement of Mr. L. J. Chawner of the Department of Commerce, Washington: "The liquidation of completely obsolete units ... will not be accomplished automatically. At the appropriate time, either private business concerns or governmental agencies must see that these structures are actually withdrawn from the market by physical demolition. As long as they exist, they will be a threat to sustained activity in poor times and to continued improvements in living standards."

Is a Solution Possible?

After completing their survey of all industries and professions interested in the construction field, the editors of "Architectural Forum" saw two possible solutions which would contribute to the improvement of the present chaotic conditions in the construction industry. Neither of these solutions, discussed below, represents the only path which the construction industry can follow in the post-war period. At present, it is not possible to draw up expert blue prints of how the construction industry should be organized after the war but it is desirable to discuss the broad principles which will underlie any scheme for reorganizing the industry in such a way that it may meet the requirements of the post-war period. It is in this light that the following two suggestions should be read.

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(1) Ibid., pp. 75-76.

[illegible] as soon as possible. [illegible] The result has been the erection of buildings [illegible]

[illegible] "Intelligent selling of the product, [illegible] will be a great opportunity for the [illegible] building industry." [illegible] successful building business.

Legislation

[illegible] (1)

[illegible]

Is a Solution Possible?

[illegible]

(1) Ibid., p. [illegible]

Suggestion 1. Figure VII shows the possible effect of a widespread application of the system of production envisaged by the proponents of pre-fabrication. This arrangement is, first of all, vastly simpler than that which existed before the war. Secondly, it extends the area of integration considerably so as to include sub-assembly (manufacture of wall, floor and roof panels, plumbing units, etc.) as well as a considerable part of the design operation. Distribution is left in the hands of a "dealer" who takes care of final assembly, including construction of those parts of the building which are not pre-fabricated and who presumably is also responsible for site development, servicing and arranging for long-term financing.

In addition to more efficient utilization of labour, the biggest advantage of this plan, is that it centralizes the purchase of building parts. As a result, parts can be obtained at wholesale direct from the manufacturer (relieving him of the headaches of a diffuse dealer-servicing organization) and passed on to the consumer with but one or two middlemen's profits, based not on the individual parts but on the entire house.

A further advantage is that house design is put on a competitive mass-production basis which should permit and stimulate a vast amount of careful, detailed study which is now impossible under the typical architect-client and builder-buyer relationship. This is badly needed to develop houses which can compete on an equal footing with other consumer goods in the highly competitive post-war market.

Some efforts in the direction indicated above are being made presently in the United States. In spite of the fact that the above suggestion presents a definite improvement over existing conditions, it is doubtful whether the pre-fabricators' plan of operations could become the basis of really extensive post-war building. The reason for this is a fault which it shares with present building procedures: it makes no provision for orderly liquidation -- that is, for rebuilding. At the present stage of national and urban development, widespread construction activity depends to some extent on provisions which take care of liquidation of obsolete units. Otherwise, the deadweight of almost a century's accumulation of worn-out but still habitable buildings will limit the amount of new construction, as it has in the past, to needs arising from the actual increase in population, immigration and changes in land use such as the expansion of commercial areas into sections formerly occupied by residents. (1)

Suggestion 2. Figure VIII shows a possible union of the methods of the pre- fabricator with that of the large-scale operative builder in which, for the first time, complete integration of the entire industry around its real product, the building on a suitable site in a suitable community, becomes possible. The key factor in this picture is the large-scale entrepreneur. His functions include final assembly, long-term financing, servicing and finally liquidation of worn-out facilities. The latter means the removal of obsolete buildings in proportion to new construction - in a way as to assure satisfactory and continuous replacement of residential dwellings. This would provide some assurance that municipal services are not over-extended in order to supply purely peripheral development of a city unless such an expansion is part of a master plan directing city growth into well considered and proper channels. The development of existing urban areas depends on the active co-operation of local authorities which will undoubtedly be forthcoming in the post-war period.

By the logic of the arrangements shown in Figure VII the pre-fabricator, as a producer of sub-assemblies, moves up into position parallel to that of manufacturers of other materials and equipment. His products will be sold to the large-scale entrepreneur rather than to the individual consumer. Such an arrangement is simply a continuation of a wartime trend which is perhaps more clearly marked in the United States than in Canada.

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(1) Ibid., pp. 79-81.

FIGURE VII

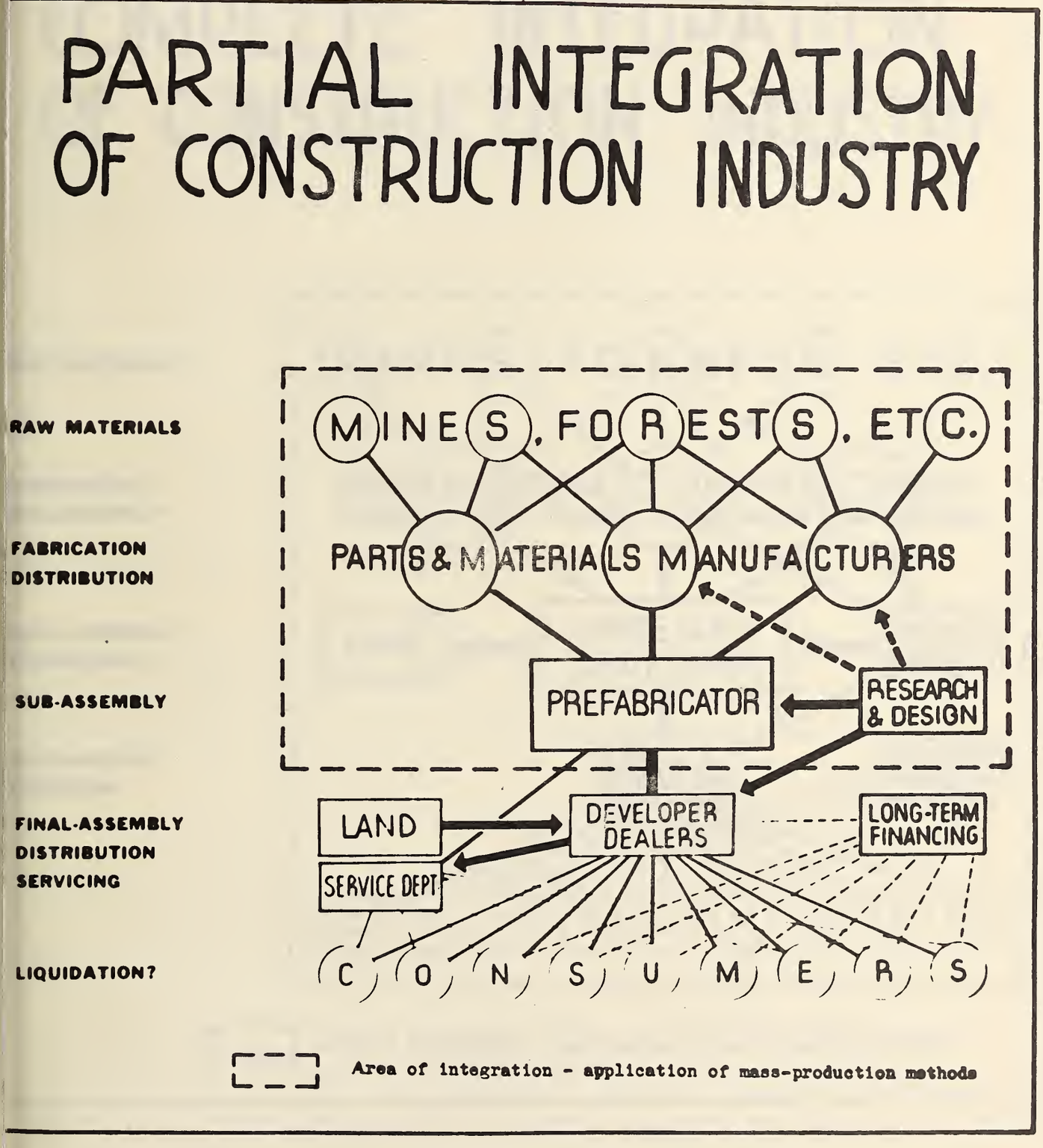

Chart showing an extension of mass-production methods by including the pre-fabricator into the area of integration. Source: Architectural Forum, New York, October 1942.

FIGURE VII

Chart showing an extension of mass-production methods by including the pre-fabricator into the area of integration. Source: Architectural Forum, New York, October 1944.

FIGURE VIII

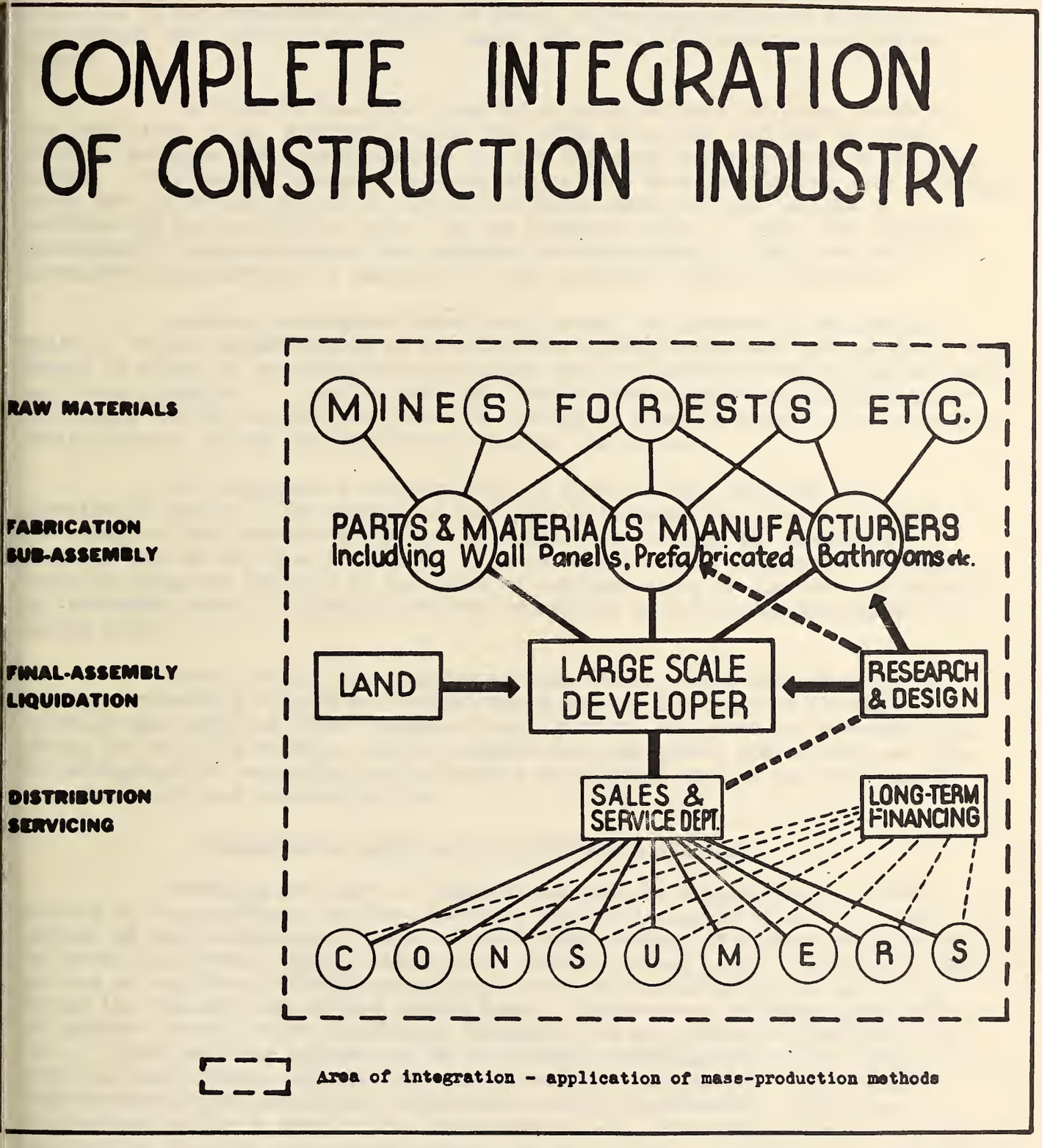

Chart showing the possible organization of all industries contributing to the final construction project in order to ensure application of mass-production methods throughout the production process. All sections are included in area of integration. Source: Architectural Forum, New York, October 1942.

Residential building activity for permanent purposes has been rather on a small scale in this country since the outbreak of the war because of the limited resources, on materials and labour. However, in recent months, with the decline of construction for industrial and defence purposes, more material and labour seem to be available for house building. In recognition of the serious housing shortage in Canada, the Honourable Mr. C. D. Howe, the Minister of Munitions and Supply, announced that some of the construction materials may be made available to any responsible builder or group of builders who will submit a development plan offering to build a number of efficiently designed and modern houses.

In order to make the financing of such building projects possible, the provisions of the National Housing Act, 1938, have been extended to allow loans to builders and land developers who are building houses to sell on the open market. This means a change in the practice of the National Housing Act; formerly, loans were primarily granted to prospective home owners and very seldom to builders who had no definite buyer for the finished house. Thus, the Canadian government is now encouraging the large-scale entrepreneur, a fact that will strengthen considerably the position of this particular group of builders.

Another development which would assist the process of integration would be for the manufacturers of conventional building materials and equipment to engage in a type of pre-fabrication of their own, the wallboard manufacturers making wall and partition panels, plumbing fixture manufacturers supplying complete bathrooms, kitchen cabinet manufacturers turning to complete kitchens and enlarging their lines to include pre-fabricated closets, and so on.

The large-scale entrepreneur, by virtue of his function as distributor, would be "in charge" of the industry's relations with the consumer. The answer to the question of whether he would sell or lease the product is probably that he may have to do both. It is doubtful that large-scale activity could be sustained entirely on the basis of outright sale, or financed exclusively by investment funds. Certainly neither course has proven wholly successful in recent years.

There is also the question of land tenure, which seems certain to undergo fundamental changes as re-development becomes the order of the day. Probably some modified form of purchase and ownership will have to be worked out, giving the building consumer greater control over his equity and at the same time the advantages of ownership, and retiring a substantial part of the developer's investment within a reasonable time.

Professional Classes and Construction Industry

Assuming some sort of organization such as suggested above, what becomes of the architect, builder, realtor, financial expert and so on? The editors of the Architectural Forum believed that services of experts would be more in demand than ever. Really large-scale activity cannot go on, according to this pattern or any other, without preempting all of the available brains and talent within the industry and related enterprises. The post-war building market will be an experts' market, where intelligent planning, and not gamblers' intuition will rule. Those building experts who do not become entrepreneurs, either singly or in suitable combinations, will be needed as consultants and employees by material manufacturers, pre-fabricators, developers, and by governments. Real pre-fabrication implies a greater need for design talent, and a greater scope for its application, than the upper-crust market, so far tapped by the architect, has ever supplied. Large-scale entrepreneurs will need economists, real estate experts, appraisers, site-planners, engineers and even sociologists to plan their activities, and all sorts of other technicians to carry them out.

Government which will probably take a more active interest in building and construction than it did in the past, will require a staff of its own to co-ordinate the plans of the various development companies and carry through a part of its own construction programme. One of the first effects of the emergence of building as an integrated industry would be the creation, for the

first time, of an integrated building profession, comprised of various divisions, including economics, planning, design, the various branches of engineering, etc., but united by a singleness of purpose and a clear understanding of the place of each type of activity in the total building scheme. (1)

Conclusion

The need for integrating the construction industry seems clearly indicated if this industry is to become an up-to-date sphere of economic activity. Some pre-fabricating firms and large contracting firms have made progress at the assembly and marketing levels. Development in this direction can be seen in Great Britain and in the United States, but very little has been done as yet in Canada.

The task of integration is one that requires imagination and vision. It cannot be solved unless the construction industry itself recognizes the trend of modern development and expresses its willingness to follow this trend. Even if this country has as yet not reached the stage of industrialization as Great Britain and the United States have, there is need for co-ordinated action of all those who ultimately depend on large-scale construction.

There will, however, be no large-scale construction in this country, especially in the residential field, unless the construction industry pulls out of its lethargy and provides the products which will be required in increasing numbers in the post-war period. If this industry is unable to fulfil its responsibilities, the government may have to step into the field of construction to a greater extent than it did in the past. Proof of this can be seen in the present development in the United States where the government has, to an increasing extent, stepped into the field of residential construction. Some measures undertaken indicate that the government is trying to contribute to integration by using modern methods of mass production of materials, pre-fabrication, site planning and large-scale development. Government departments are busy working out schedules in order to prove what reduction in costs and man-hours involved can be achieved by using mass production and pre-fabrication methods in the residential construction field.

In Canada, some experiments in this direction are found in the activity of the government owned "Wartime Housing Limited", a company employing latest mass-production methods in constructing temporary housing. This enterprise, restricted to wartime housing alone, is not in the position to do research work, experimentation and designing of permanent low cost houses (providing stability and modern conveniences). Some Canadian manufacturers of building materials have given thought to Canada's post-war house. However, large Canadian contracting firms and builders have done very little to study the problems which they are going to face after the war, should they be charged with the responsibility of carrying out an extensive post-war residential construction programme. Everybody, even the small builder, is busy these days. Time is running short and the war may end before the construction industry has made arrangements to meet the challenge of a post-war development programme.

In spite of the desire of private industry for "freedom of enterprise", a large section of the construction industry which is conscious of the requirements of a post-war economy, is urging leadership from the government (see statement of Canadian Construction Association, Section I). It seems that certain sections of the industry are quite willing to do their share if their sphere of responsibility is more clearly outlined than is the case at present.

The Dominion Government could, therefore, make an important contribution by helping to direct the productive capacity of the construction industry into channels which would bring the most desirable results. Such a purpose could be achieved:

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(1) Ibid., pp. 79-81.

(1) by a clear formulation of the problems which the construction industry has to face and solve, should it desire to play its proper role in Canadian post-war reconstruction,

(2) by the presentation of these problems to a conference, called by the Dominion Government and representative of all industries and professions participating in the completion of construction projects. In this way, the construction industry would see the whole range of problems, express their views regarding them and indicate what contribution they will be able to make towards their solution, particularly in respect of such pressing problems as the reorganization of the industry and low-cost housing,

(3) by the encouragement of all sections of the industry to plan for contingencies of a large-scale post-war residential construction programme by assuring them of a substantial market provided the industry is able to meet the requirements of low-cost and good quality houses,

(4) by the encouragement of the close co-operation of the various branches of the construction industry amongst themselves and between the industry and its working force,

(5) by making the training of new construction craftsmen the joint responsibility of the industry, labour and government and ensuring that a permanent board be charged with the introduction, maintenance and supervision of a nation-wide training programme; this programme might be carried out under the provisions of the Vocational Training Co-ordination Act of 1942,

(6) by assuring the construction industry of the co-operation of the Dominion Government by making possible for industry and labour to consult the Dominion Government, from time to time, on all problems which industry and labour are unable to solve themselves,

(7) by creating a new government agency for or entrusting an existing department with the carrying out of research work in design, building in assembly methods, the results to be made available to the public as a whole, and by encouraging architects, builders and material manufacturers to undertake research work on their own; there exists a definite need for the government undertaking research work of their own in order to be prepared in the event that private industry should fail to meet the requirements of a large-scale, low-cost housing programme, (1) and

(8) by creating a Dominion Bureau of Standards, in the beginning preferably restricted to standards of building materials but gradually developing to include other types of materials as well.

Such measures undertaken by the Dominion Government, on the one hand, mean a directive for which the building industry has been clamouring, and, on the other hand, will definitely contribute to the advancement of one of the most backward industries in this country.

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(1) The need for such research work was recognized in the United States in recent years and carried into effect at the instigation of the Central Housing Committee in 1937. Since that year, annual appropriations are made to "study the properties and suitability of building materials, with particular reference to their use in low-cost housing, including the construction of such experimental structures as may be necessary for this purpose, provided that no part of this program shall duplicate any work now being performed by the Forest Products Laboratory of the Department of Agriculture." (See Letter Circular L.C - 542 of the National Bureau of Standards, July 30, 1937.)

APPENDIX I

IMPROVEMENT OF THE ORGANIZATION OF THE CONSTRUCTION INDUSTRY

by

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The proposals relating to possible improvement of the present organization of the construction industry should be seen in the light of past experience.

Division of the Construction Industry

The construction industry is sharply divided into two main divisions, the first consisting of contractors and the second of speculative builders. The contractors as their name implies operate under contract for specific projects. On the other hand the speculative builder does not contract for his work, but being the owner as well as builder, he is the initiator of the projects which he undertakes. This difference in the conditions under which each conducts his business has far reaching effects upon their respective fields of operation, their relations with labour, finance, material, supplies and designing agencies, which must be thoroughly understood before a study of possible improvement in organization can be made.

The contractor by the terms of his contract is rigidly restricted as to, the kind, quantity and quality of materials to be used in construction, and as to the times at which he must pay for such materials. He is also bound as to the competence and type of methods of paying labour employed on the work. Generally he is also restricted as to whom and under what conditions he may sublet any parts of the work. Furthermore most contracts include a time limit for completion which is the essence of the contract.

The form, materials and workmanship of the project and its parts is prescribed by the owner, through his plans and specifications, deviation from which is not within the powers of the contractor.

Such discretionary powers as the contractor possesses are entirely related to his own organization and its skill and ingenuity in accomplishing the prescribed result in such a way as to result in a profit to him.

Generally speaking the work of the contractor is subject to the oversight and inspection of the Owner's architect, whose duty it is to see to it that the plans and specifications are adhered to, and who alone possesses the power to authorize changes in the work on behalf of the owner or on account of emergencies concerning the safety of the structure or the protection of personnel from injury.

The speculative builder is subject to none of the restrictions under which the contractor operates as the result of his contract. Subject only to the requirements of building ordinances he is a free agent in the choice of materials and labour and methods of paying for them. Such plans and specifications as he uses are of his own making and may be adhered to or disregarded at will. The architect has no place in his scheme of affairs except as an employee. While the contractor's profit and remuneration arises out of his ability as a constructor, the profit and remuneration of the speculative builder rests entirely upon his ability to sell his building for more than it cost him.

Relation with labour are important with respect to these two divisions of the industry. The contractor upon entering into a contract is bound to employ only skilled mechanics. Due to the strength of organized labour unions in which are found the vast majority of skilled tradesmen, he must employ union labour, at union wage rates and subject to union jurisdictional practices. In short, he must pay his men weekly at the hourly rate in force, and is on large work dependent upon the unions for the choice of men to be employed. As a matter of interest, relations between contractors and organized labour are on the whole satisfactory and the strike or lockout is practically unknown in the contracting business.

Labour and the Industry

Relations between organized labour and the speculative builder on the other hand, can best be described as non existent. Speculative builders do not employ union men, preferring to take their chance on the floating supply of non union mechanics. They are able to ignore the unions largely because due to the size of individual projects skilled labour, if employed at all, is required for very short intervals. The difficulty which confronts the contractor who has perforce to employ many different trades simultaneously, and therefore cannot use non union men concurrently with union labour does not arise with the speculative builder, who when necessary to avoid conflict, arranges his progress schedule so that trades employing non union labour are not on the work at the same time as the union men. Naturally organized labour resents this practice, and have made many attempts to organize the speculative builders' labour supply without success.

Perhaps the greatest obstacle in the way of organization is the device used by the speculative builder known as the "labour contract". Under this system, a group of workmen contract for the labour of a particular trade on a lump sum basis, the figure being considerably lower than they would receive were the work done for an hourly wage. However, by working long hours including Saturdays and holidays the low hourly rate accruing to them is more than offset by a much greater monthly income than is received by union labour. In spite of the illegality of this system which is prohibited in Ontario by the Industrial Standards Act, it is popular and common in the speculative building field. It has two important effects, namely more money per month or year for the mechanic and lower labour costs per unit of construction for the builder. I do not possess any accurate figures, but I am told that the contract labourer earns nearly double the annual income of the union labourer and that also the speculative builders' labour costs per unit are nearly half that of the contractor for the same class of work. As an example, in the Toronto area, labour and mortar for brickwork costs the Contractor $25.00 per thousand while the cost to the speculative builder is only $13.00 per thousand.

Material Standards and Costs

In the matter of materials somewhat the same proportionate difference exists. The contractor in purchasing his materials buys to standards set by the specifications which are generally high. The price range in the higher quality materials is extremely small, in fact some materials such as glass are sold at a uniform price. The speculative builder seldom purchases the top grades in any material, preferring the great price variation and opportunities for bargains in lower grades, which have a tendency to accumulate and must be cleared out at whatever they will bring. This is particularly true of wood products which form a substantial fraction of construction materials. Bargain prices in such materials not only apply to the actual price, but also to the terms on which they are sold. Credit being freely advanced in order to assure their sale and removal. Being a free agent the speculative builder has the benefit of this market condition.

Finance and the Industry

Still another point of difference is the relation of finance to the two divisions of the industry.

Contractors require capital for their operations consisting of a certain amount of equipment and plant and funds for month financing of material purchases and payrolls. Since payment is made to them generally monthly pro rata as the value of the structure is increased, the amount of working cash required is small in comparison with the amount of their contract. Generally speaking a contractor with ordinary credit standing can operate his business with cash amounting to not over 10% of the total amount of all contracts undertaken. The responsibility for providing the money for the project rests entirely with the owner.

Speculative builders on the other hand require sufficient capital to pay for all materials and labour used in their projects. This capital is rarely supplied by the builder himself but is obtained for each project through a first mortgage loan which is expected by the builder to be large enough to cover the cost of all his labour and materials and land as well.

During good times when the market is rising the lending institutions in valuing the project run no risk in placing their valuation well above the cost of production. During a falling market however, valuations generally are little above and may even be below the cost of production. Once the valuation drops below a point where the amount borrowed fails to meet the cost of production, speculative building ceases as it did in the depression.

The raising of the lendable proportion to 80% under the N.H.A. was an attempt to meet this situation and it was successful, coupled as it was with the existence of a buyers market for labour and materials, both of which suffered serious reductions.

Quality and Relative Costs

Subject to the design itself, the product of the contractor is first class, well constructed good materials and possessing a permanent value. The cost however is relatively higher than its mere quality would seem to warrant. This is due primarily to the premium paid for No. 1 materials and to the inordinately high labour costs. Furthermore buildings in this category are individually designed for specific purposes and even when the project is relatively large there is little opportunity for the utilization of standardized elements. Of course, within the design itself standardization of window and door sizes and patterns is common, but the standardization does not extend beyond the individual project.

Another element in the cost is the high overhead cost of the contractor. This is the result first of failure of individual firms to maintain a continual state of activity, a condition inherent in the contract system, and second the system of competitive tendering wherein each bidder must go to the expense of estimating quantities from the plans and specifications. The cost to the unsuccessful bidders is an item of overhead expense that must be eventually absorbed in the price of contract work actually obtained.

For example if fifteen contractors tender on a building to cost $100,000.00 each of the fifteen will spend approximately three hundred dollars in preparing his bid. To fourteen of them this expenditure will be dead loss. Multiply this by the number of times a year each will submit an unsuccessful tender, and some idea of the magnitude of this unproductive expenditure will be apparent. The present system of competitive tendering is supposed to produce the lowest costs obtainable to the owner. This it does as between one contractor and another but actually the owners as a whole must pay the additional costs by the system.

In the speculative building field no competitive tenders are submitted and this cost for estimating does not affect the builder. However he has to bear the cost of financing his projects and of selling them as well.

On a similar sized project viz. $100,000.00 he has to absorb the interest on the loan until a sale is made and the real estate agents commission on the selling price which would probably amount to a total of $5,000.00 of unproductive expenditure.

On a comparative basis, the speculative builder is much worse off than the contractor in the amount of wasteful expenditure.

On the other hand his direct cost of production is probably about 75% of that of the contractor on a similar project, and as low as 50% when one considers the difference in the quality of their respective products.

Speculative building does not produce the same kind of construction as does the contract. Generally speaking the design is weak and ignores modern aesthetic and technical developments. The materials and workmanship are definitely low grade and the structure possesses little permanent value.

The Division of the Field

The construction field is distinctly divided between the contractors and the speculative builders.

Contractors have a monoply of large government, commercial, institutional and industrial building. Excepting for a small proportion of built to order dwellings the speculative builder has the residential field to himself, and an actual monopoly of all residential building constructed for sale.

The net result of this division is that the prospective house purchaser, and indeed the tenant as well, has no opportunity of obtaining well designed, well built or modern housing. He must be content with jerry built construction conforming to the ludicrous design concepts of the average speculative builder.

Credit and the Industry

The prompt payment of bills for goods and services is a prime condition of good credit standing in all commercial undertakings except in the building industry. Due to the existence on the statute books of all provinces of various Mechanics Lien Acts, the supplying of materials to a building project is given a right of lien against the property to the value of the materials delivered. Once the materials are delivered whether incorporated into the building or not, payment is automatically assured. The purchaser's reputation ceases to be of much importance, and in fact is generally ignored, particularly where 60 day or 90 day credit is advanced.

With both mortgagee and supply dealer fully protected by the mortgage and the lien respectively, the builder ceases to have any importance other than an agency through which mortgage loans are made and building supplies are sold. His position is that of a strawman who can and does operate his business on shoe string financing.

The responsibility for the deplorable situation in the speculative building industry, whereby incompetent people are engaged in building resulting in jerry building and its consequent results, rests squarely on the shoulders of the lending institutions and the building supply dealers, neither of whom have shown the slightest interest in good design or construction as a condition to their participation.

In the field of contract building the lending institutions are of no importance. Credit standing on the other hand is vastly important since the cash discount on materials is an important saving available to the contractor who pays his bills promptly. Furthermore the contract exercised by the supervising architect in the matter of authorization of payments by

the owner is a guarantee that materials and labour are paid for as a condition to an advance by the owner.

Suggestions for Improvement in Organization

The following are my suggestions for improvement:

(1) The Contractor: (a) The present system of preparing competitive tenders should be replaced by the "guaranteed quantities" system whereby each contractor bidding, is provided with a complete quantity survey prepared by the architect or a qualified quantity surveyor and upon which quantities he prepares his tender and receives payment. The wasteful system of separately prepared quantity lists by each contractor would thereby be eliminated. This system is in general use in Europe and Great Britain where the "quantity surveyor" charges a fee of 1% of the cost of the project for his services. In the case of the $100,000.00 building previously cited the present system assuming fifteen bidders costs roughly 4½%. The lead in this reform could well be given by governments, in handling public works undertakings.

(b) Some method should be found whereby the high hourly wages paid to labour could be drastically reduced by assurance of permanent employment at an adequate monthly or yearly remuneration.

(2) The Speculative Builder: (a) The repeal of that part of the Mechanics Lien Acts giving supply dealers the right of lien, thereby eliminating the incompetent shoe string builder.

(b) The insistence by lending institutions of architectural control over design and construction, as a prime condition to the lending of money to builders.

(c) The enforcement of the law against labour contracting, and the enforcement of the minimum wage sections of Industrial Standards legislation.

(d) Competency on the part of the builder to be insisted upon by municipal authorities before permits are issued to him.

(3) The Architect: At present the architect has no place in the scheme of things as far as residential building for sale is concerned. This field which covers over 90% of all houses built is at present barred to the ideas of the architectural profession. The general employment of architects for residential design would at once bring their best efforts to bear upon its problems. I am positive that the result would be electrifying only upon the physical aspects of these buildings but also upon the public mind as well. Certainly the interests of the lending institutions would be well served, in the greater intrinsic value of the surety.

Supported by modern design and modern techniques the builder would reap a golden harvest and at the same time be able to offer a better product to the public at a lower price than he now offers the veriest junk. Given the opportunity the architectural profession would quickly apply the technique of standardization and mass production to a degree not possible in the variable functional requirements of commercial and other buildings.

(4) Unification of the Industry: Under the improved system suggested there is no reason why the contractor may not also be a speculative builder and vice versa, and with competition from speculative jerry building eliminated the contractor might well employ his abilities and capital in large scale residential developments initiated by himself.

By so doing full time employment of building labour could be achieved with consequent reduction of labour costs.

With residential building put on a large scale, under architectural control, not only would the standard of design and construction be raised and by the reduction of labour costs through steady employment and the economies of standardization and mass production costs would react definitely downward.

The sales appeal of new and modern design built to high standards, and at reasonable prices could not fail to stimulate the industry for both contractor and speculative builder alike. In fact these two now widely separated branches of the industry would inevitably merge without distinction.

APPENDIX II

LICENSING OF BUILDING CONTRACTORS

An Address by W.B. Sullivan of Sullivan and Fried, Toronto, made at the Fifteenth Annual Convention of the Canadian Construction Association in Windsor on January 24th to 26th, 1933.

When an industry or profession reaches such a magnitude that it can become a menace to the general public which it serves, then, I believe, that industry or profession should be controlled by legislation for the safety and protection of society as a whole. This statement is amply justified by the control exercised today over medicine, dentistry, architecture, electrical contracting, sanitation and other industries or professions that directly affect the well-being and safety of society. Can you imagine the consequences if there were no qualifications or standards to regulate these very important services to humanity?

Is the construction industry any less important? Are the men engaged in it any less entitled to recognition as workers in a highly specialized calling? Being unrestricted as it is at present, has not the building industry reached a stage where it has become a menace to the public through the operations of those individuals within its boundaries who do not possess the qualifications or the integrity to assume the responsibilities of the business? If you doubt this assertion look around your own city and you will find numerous examples of buildings and houses which are nothing more or less than burdens of maintenance to their owners, to say nothing of the financial losses that may have been occasioned by their construction.

Two of the prime requisites of life are food and shelter. The largest single investment of the average man is in his home. One of the largest investments of a business enterprise is in the factory or office building in which it carries on its activities. Are not both of these groups entitled to have some guarantee that the individual or firm who undertakes to construct these homes and mercantile structures is capable of doing this work safely, economically and honestly. Also, should not the industry itself be protected against the individual who, due to his lack of knowledge, skill or experience, beings disrepute on a business that ranks among the first in volume and importance to the country?

It is with the thought in mind of providing a guarantee and setting up definite standards of qualifications that the licensing of contractors has been brought forward.

The Arguments For and Against

The arguments may be advanced against licensing that we have competent architects whose job it is to supervise the acts of the contractor; that we have building bylaws to regulate the safety of construction; that we have building departments with inspectors to see that the bylaws are carried out; that we have agreements with various labour unions setting forth the scale of wages; that we have the courts to settle legal cases and the lien acts to protect the money. The opponents of this act may possibly say that surely with all these the public and ourselves are now amply protected without placing any further legislation on the statute books.

What is the answer to these arguments? Architects will tell you that in spite of the most careful supervision it is impossible to get good work from an individual who simply does not possess the capacity or ability to do it. Building bylaws are being broken every day. In a large city it would be prohibitive to engage enough inspectors to completely supervise all construction work. The city architect of any city will tell you what his problems are. Wages are being cut and shashed in spite of agreements. Trade associations cannot control the irresponsible contractor. He carries on his unethical practices unrestricted, and the general public suffers accordingly. How many court actions have resulted in complete satisfaction to the owner? How many

liens have been put on buildings where the money, if received at all, was only a portion of the whole? What about the many parts of the country where there are no building bylaws or city building departments? Then again, look at the great amount of building that is, unfortunately, being done and will continue to be done without the services of a competent architect to supervise construction? Particularly is this true in the field of speculative house and store building. Is it not obvious that the public needs something that will stamp out, at the very beginning, the cause of all these unnecessary complaints? To every right thinking man in the industry the answer must be yes. The question then arises, what can be done that will not impose further penalties on an already overburdened industry or conflict with the already existing trade associations and the important work which they are doing?

The remedy is quite simple. In plain words, make it impossible for anyone to engage in the practice of construction work as a contractor unless he is qualified by training, experience and integrity to assume the responsibilities and obligations of his chosen calling. This can be brought about by making application to the government to enact legislation to create and establish a provincial board for the licensing of contractors, this legislation to be in the form of an amendment in the Municipal Act so as to permit municipalities, if they so desire, to enact regulations requiring contractors operating within said municipality to be licensed in accordance with the provisions of the act.

Will Check Irresponsibility

Licensing of contractors is not a complete solution for all the ills of the industry but it will accomplish what we are most concerned with, and that is, the elimination of the irresponsible contractor together with the untold losses that his unrestricted operations occasion. This statement is not one conjured up from my own imagination. It is prompted by evidence and data from those states across the line where licensing, such as we recommend, has been in force for some time.

Let us quote from an article by L. F. Danforth of the Department of Professional and Vocational Standards of the State of California, in speaking of the licensing law now in operation in that state. "It was the purpose of the framers of the state contractors' law to raise all branches of the contracting business to a high, cleaner and more ethical plane. Those who are administering the law tell us that beyond question the law is accomplishing this purpose."

The sooner we adopt a similar policy the sooner we will enjoy the benefit of an industry organized and conducted on lines befitting its place as one of the prime necessities of life and the most important factor in the general improvement of economic conditions in our country.

APPENDIX III

CONSTRUCTION TRADE UNIONS AFFILIATED WITH THE TRADES AND LABOUR CONGRESS.

Statistics available in the Thirty-First Report on the Labour Organization in Canada (1941) indicate only to a small extent the impact of the present war on trade union organizations. Some indication may be obtained from the growth in the number of locals of construction trade unions affiliated with the Trades and Labour Congress. The following table shows a ten percent increase of the number of locals in September 1942 above the level of 1940.

TABLE X

LOCALS OF CONSTRUCTION UNIONS AFFILIATED WITH THE TRADES AND LABOUR CONGRESS OF CANADA, 1940 and 1942.

Type of Union	Number of Locals, 1940(1)	Number of Locals, 1942(2)
Bricklayers, Masons and Plasterers International Union of America	43	35
Bridge, Structural and Ornamental Iron Workers International Association	2	4
Brotherhood of Painters, Decorators and Paperhangers of America	20	24
Granite Cutters' International Association	2	2
International Brotherhood of Electrical Workers	51	56
Plasterers and Cement Finishers' International Association	7	10
Sheetmetal Workers' International Association	15	16
Stonecutters' Association of North America	10	11
United Association of Plumbers and Steam Fitters	37	38
United Brotherhood of Carpenters and Joiners of America	94	107
Wood, Wire and Metal Lathers' International Union	1	7
TOTAL	282	310

(1) Data taken from "Thirtieth Annual Report of Labour Organizations in Canada, 1940, pp. 67 ff.

(2) Date taken from "Canadian Congress Journal", Montreal, September 1942, Vol. XXI. No. 9.

TABLE XI

PROVINCIAL DISTRIBUTION OF LOCALS OF CONSTRUCTION TRADE UNIONS AFFILIATED WITH THE TRADES AND LABOUR CONGRESS OF CANADA, 1940 (1)

Type of Union	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Canada
Bricklayers, Masons and Plasterers International Union of America	1	2	1	30	1	3	2	3	43
Bridge, Structural and Ornamental Iron Workers International Association	-	-	-	1	-	-	-	1	2
Brotherhood of Painters, Decorators and Paperhangers of America	1	1	2	9	1	1	2	3	20
Granite Cutters' International Association	-	-	-	1	-	-	-	1	2
International Brotherhood of Electrical Workers	4	4	6	23	5	2	4	3	51
Plasterers and Cement Finishers' International Association	1	-	-	3	-	1	1	1	7
Sheetmetal Workers' International Association	1	2	2	4	-	-	3	3	15
Stonecutters' Association of North America	-	-	2	5	1	-	1	1	10
United Association of Plumbers and Steam Fitters	1	4	3	18	2	2	4	3	37
United Brotherhood of Carpenters and Joiners of America	6	5	15	51	1	1	3	12	94
Wood, Wire and Metal Lathers' Internation Union	-	-	-	-	1	-	-	-	1
TOTAL	15	18	31	145	12	10	20	31	282

(1) Table compiled from "Thirtieth Annual Report of Labour Organizations in Canada, 1940," pp. 67 ff.

TABLE XII

REGIONAL DISTRIBUTION OF CONSTRUCTION TRADE UNIONS AFFILIATED WITH THE TRADE AND LABOUR CONGRESS, 1940 (1)

(a) Bricklayers, Masons and Plasterers' International Union of America

CANADA - 43

NOVA SCOTIA - 1

Halifax

NEW BRUNSWICK - 2

Fredericton
Saint John

QUEBEC - 1

Montreal

ONTARIO - 30

Belleville
Brantford
Chatham
Collingwood
Cornwall
Fort William
Galt
Guelph
Hamilton
Kingston
Kirkland Lake
Kitchener
London
Niagara Falls
Orillia
Ottawa
Pembroke

ONTARIO (continued)

Peterborough
Port Arthur
St. Catharines
St. Thomas
Sarnia
Smiths Falls
Stratford
Toronto (4)
Windsor
Woodstock

MANITOBA - 1

Winnipeg

SASKATCHEWAN - 3

Moose Jaw
Regina
Saskatoon

ALBERTA - 2

Calgary
Edmonton

BRITISH COLUMBIA - 3

Vancouver (2)
Victoria

(b) Bridge, Structural and Ornamental Iron Workers' International Association

CANADA - 2

ONTARIO - 1

Toronto

BRITISH COLUMBIA - 1

Vancouver

(c) Brotherhood of Painters, Decorators and Paperhangers of America

CANADA - 20

NOVA SCOTIA - 1

NEW BRUNSWICK - 1

Saint John

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(1) Table compiled from "Thirtieth Annual Report of Labour Organization in Canada, "1940, pp. 67 ff. Information is provided for cities and towns, provinces and Canada as a whole. Figures in brackets following names of cities mean that there exist more than one local union in this particular city.

(c) Brotherhood of Painters, Decorators and Paperhangers of America (continued)

QUEBEC - 2

Montreal (2)

ONTARIO - 9

Hamilton
Kingston
Ottawa
St. Catharines
Toronto (5)

MANITOBA - 1

Winnipeg

SASKATCHEWAN - 1

Regina

ALBERTA - 2

Calgary
Edmonton

BRITISH COLUMBIA - 3

Vancouver (2)
Victoria

(d) Granite Cutters' International Association

CANADA - 2

ONTARIO - 1

Toronto

BRITISH COLUMBIA - 1

Vancouver

(e) International Brotherhood of Electrical Workers

CANADA - 51

NOVA SCOTIA - 4

Halifax (2)
Liverpool
Sydney

NEW BRUNSWICK - 4

Bathurst
Dalhousie
Moncton
Saint John

QUEBEC - 6

Montreal (3)
Quebec (2)
Three Rivers

ONTARIO - 23

Collingwood
Espanola
Fort William
Guelph
Hamilton (2)
Iroquois Falls
Kapuskasing (2)
Kingston
London
Ottawa

ONTARIO (continued)

St. Catharines
St. Thomas
Stratford
Thorold
Toronto (4)
Windsor (2)
Point du Bois

MANITOBA - 5

Winnipeg (5)

SASKATCHEWAN - 2

Moose Jaw
Saskatoon

Alberta - 4

Calgary
Edmonton (2)
Lethbridge

BRITISH COLUMBIA - 3

Prince Rupert
Vancouver
Victoria

(f) Plasterers and Cement Finishers' International Association

CANADA - 7

NOVA SCOTIA - 1

Halifax

ONTARIO - 3

London
Ottawa
Toronto

SASKATCHEWAN - 1

Regina

ALBERTA - 1

Edmonton

BRITISH COLUMBIA - 1

Vancouver

(g) Sheetmetal Workers' International Association

CANADA - 15

NOVA SCOTIA - 1

Halifax

NEW BRUNSWICK - 2

Moncton
Saint John

QUEBEC - 2

Montreal (2)

ONTARIO - 4

London

ONTARIO (continued)

Ottawa
St. Thomas
Toronto

ALBERTA - 3

Calgary (2)
Edmonton

BRITISH COLUMBIA - 3

Vancouver (2)
Victoria

(h) Stonecutters' Association of North America

CANADA - 10

QUEBEC - 2

Montreal
St. Mare des Carrieres

ONTARIO - 5

Hamilton
Kingston
London
Niagara Falls
Ottawa

MANITOBA - 1

Winnipeg

ALBERTA - 1

Edmonton

BRITISH COLUMBIA - 1

Vancouver

(i) United Association of Plumbers and Steam Fitters

CANADA - 37

NOVA SCOTIA - 1

Halifax

NEW BRUNSWICK - 4

Bathurst

(i) United Association of Plumbers and Steam Fitters (continued)

NEW BRUNSWICK (Continued)

Dalhousie
Moncton
Saint John

QUEBEC - 3

Montreal (2)
Quebec

ONTARIO - 18

Collingwood
Hamilton
Kingston
Kirkland Lake
Kitchener
London
North Bay
Ottawa
Port Arthur
St. Catharines
St. Thomas
Stratford

ONTARIO (continued)

Timmins
Toronto (3)
Welland
Windsor

MANITOBA - 2

Winnipeg

SASKATCHEWAN - 2

Regina
Saskatoon

ALBERTA - 4

Calgary (2)
Edmonton (2)

BRITISH COLUMBIA - 3

Vancouver (2)
Victoria

(j) United Brotherhood of Carpenters and Joiners of America

CANADA - 94

NOVA SCOTIA - 6

Glace Bay
Halifax
Moser's River
New Waterford
Sheet Harbour
Sydney

NEW BRUNSWICK - 5

Saint John (4)
Westfield

QUEBEC - 15

Grand'Mere
Montreal (6)
Quebec
Rouyn
St. Anne de Bellevue
St. Hyacinthe
Sherbrooke
Sorel
Three Rivers
Valleyfield

ONTARIO - 51

Barrie
Belleville
Blind River
Brantford

ONTARIO (continued)

Cobourg
Collingwood
Cornwall
Dundas
Field
Fort Erie North
Fort Frances (4)
Fort William
Guelph
Hamilton
Kincardine
Kingston
Kirkland Lake
Kitchener
Larder Lake
London
Mattawa
Merriton
Mimico
Niagara Falls
Norman
Oshawa
Ottawa
Parry Sound
Pembroke (3)
Peterborough
Port Arthur (3)
Port Colborne
Preston
St. Catharines
St. Thomas.

(j) United Brotherhood of Carpenters and Joiners of America (continued)

ONTARIO (continued)

Sault Ste. Marie
Stratford
Thessalon
Thorold
Timmins
Toronto (2)
Welland
Woodstock

MANITOBA - 1

Winnipeg

SASKATCHEWAN - 1

Regina

ALBERTA - 3

Calgary
Edmonton
Lethbridge

BRITISH COLUMBIA - 12

Nanaimo
Nelson
New Westminster
Port Alberni
Powell River
Prince Rupert
Vancouver (4)
Victoria (2)

(k) Wood, Wire and Metal Lathers' International Union

CANADA - 1

MANITOBA - 1

Winnipeg

APPENDIX IV

A STUDY OF METHODS FOR INCREASING THE INCOME OF CONSTRUCTION WORKERS

By J. L. Kingston (1)
Secretary of the National Joint Conference Board

At the January 14th meeting of the Board the subject of workmen's annual income was discussed, and an extract from the minutes of that meeting is quoted:-

> "Following Mr. McLeod's outline of handicaps faced by the bricklayers' trade because of the difficulty of working during freezing and inclement weather, Mr. Frid suggested that a study be made and reported to the Board, the subject of this study being a search for practical ways of increasing the annual wage of construction workers, now out of line with the hourly wage scale, for instance by means of carrying on more building operations during the winter months. Any progress in this direction would help the stabilization of workmen's income."

It is not the intention here to discuss at length the hourly wage rates. The one comment to be made concerning them is that, hourly rates assuming them to remain unchanged, whatever improvement may be made to convert idle time into work, time will increase the workman's annual income. A larger number of working hours means more work produced. The volume of construction will continue to grow so long as there is a healthy building market or, in other words, so long as there is work to be done and the public is able and willing to pay for it.

The present war emergency has created such a situation, and looking ahead to the years of reconstruction and beyond it will be readily agreed that we in Canada can use many more buildings of various kinds, houses, schools, hospitals, government buildings, commercial structures, factories, to mention only a few. In fact we will need these and more for the fuller life we hope Canadians are to live. If they are to be added to our wealth at a more rapid rate than heretofore, there must be more labour expended, and to pay for this the building industry must either

(1) receive more money from the public; or

(2) economize on the cost of material and overhead.

Receiving more money from the public. To discuss this here would be to enter a field of economics far beyond the scope of this study, but it must nevertheless, be recognized that the need for new building in a young and virile country is necessarily of vast proportions. People will always want new accommodation; and requirements in building change with changing times. The only hindrance to the fulfilment of this demand has hitherto been the lack of ability to pay for it. Thus the problem hinges on the state of prosperity of business in general. The building industry will always be active so long as business in general is sufficiently flourishing to support it.

Economy in the cost of material and overhead. If a normal balance is to be kept between construction and other branches of industry, while at the same time the yearly income of the building worker is to be increased then either the cost of material must be reduced, or else the number of workmen employed must decrease. The latter would be an evil to be guarded against, unless appropriate employment can be provided for the remainder.

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(1) This memorandum represents the personal opinion of Mr. J. L. Kingston, an architect by profession, who possesses considerable knowledge of the intricate problems facing employers and employees alike in the building and construction industry.

Having stated the problem and glanced at some of its implications, the next step is to examine possible ways of expanding the work year. These fall into two classes:

(1) Commencing earlier in the spring and working later into the autumn;

(2) Eliminating interruptions of work because of inclement weather.

Commencing earlier in the Spring and working later into the Autumn. Few owners and promoters realize the loss and confusion caused by failure to formulate their building programmes early enough to have them properly studied before the building season opens. This realization is rarely felt beyond the confines of the drafting rooms and offices of architects and engineers. True enough, architects can produce their designs and specifications quickly, and contractors, if they have to , can tender on big work almost overnight. This hurried method, however, involves inaccuracy of estimate which every effort should be made to avoid. Should owners recognize the necessary extravagance for which it is responsible, and for which they have to pay, they might readily change their habit.

The owner receives a design from the architect but when the work is rushed he seldom gets the best and most efficient planning and detailing or concise specification. These factors tend to carry with them undue margins in the contractor's quotation to cover uncertainties concerning plans and specification. If the contractor does not 'cover' with margins, he is exposed to risks of loss, creating a bad situation for him, which often rebounds to the architect and the owner and everyone on the job. Such predicaments are dispelled if the design, working drawings and specifications have been carefully worked out and the contractor has had time to figure carefully.

Without the owner's appreciation of the time required to properly prepare a project for contract, the structure when completed is too often either poor in arrangement and more expensive than it should be, or else the architect's studying time encroaches into the building season. Thus, construction starting too late runs on into expensive out-door building in the following winter. Whatever means therefore can be found, should be used to impress upon prospective owners and promoters the need for office study before the letting of contracts. Journalists and publicists can do much to help in correcting this unfortunate situation. The daily papers, financial sheets and technical journals other than those of the building industry should be used to bring this home to prospective owners whose every day interests are removed from the field of construction.

Excavation. With the great advance during recent years in the strength and power of builders' machinery, excavation can sometimes be started before the frost leaves the ground. This, unfortunately, is only practicable on jobs big enough to warrant the use of power drills, power shovels and heavy equipment. As things were up to the start of the war building, the greater proportion of Canadian construction, being residential and minor commercial in character, was too small to make practicable the use of this heavy equipment, and so for it excavation had to wait until the ground was free of frost.

When the use of heavy plant is practicable, excavation can be completed and the forms for concrete foundations and first floor slabs erected before frosty weather is over. Then the concrete can be poured during the first mild weather.

Jobs of the size warranting heavy mechanical equipment for excavation are usually so big that they run on through the summer to the next season's frost. The reward of an early beginning will then be that the building is well closed in before the following autumn, and the builder left more free to attend to the harvest of jobs that always come at that season.

Concrete. The setting of the concrete involves a chemical change which takes place within the ingredients of the aggregate. Like most other chemical changes the action is more rapid when the substances are warm. The 'set' progresses very slowly in cold weather and not at all when the freshly mixed concrete freezes. Because this chemical action generates a little heat,it has been accepted among some

engineers as permissible to pour concrete during a few degrees of frost, but only if it is in large masses such as are common in railway work and hydro-electric dam construction. With the sizes customary in building construction, i.e. columns and beams and floor slabs, or even 12 or 15 inch foundation walls, concrete should never be poured in freezing weather. This is even more emphatically the case with mortar, spread thin as it is for jointing in brickwork. These conditions then limit the winter starting of large buildings to excavation and concrete forms.(1) For smaller work, as stated heretofore, it is very costly even to excavate before the frost has left the ground.

It would appear then that the only work which may be practically proceeded with before the ground is thawed is the excavation and erection of basement and lower storey forms for concrete in the large buildings. If, however, this practice were more often followed, and in small scale work if excavation were started immediately upon the softening of the ground, the first step towards advancing the work programme would be accomplished.

Shop Fabrication. From time immemorial certain building materials have been fashioned either partially or to their finished state in places removed from the site. Brick has always been burned in the brick-yard and wood cut into boards and beams and seasoned in the saw mill, kiln and lumber yard, while doors, windows and parts of the finished joinery have been worked to their completed state in a shop removed from the site. Since the turn of the century this practice of fabricating building parts away from the job has grown tremendously.

The growth of this branch of the industry, i.e. that of building-material supply, has been for the most part individualistic and not sufficiently co-ordinated with the building industry as a whole. It affects operations within nearly every part of the industry as well as the successful joining together of the work of one trade with that of another. The lack of co-ordination of one manufactured part with that of another causes confusion and delay. It imposes care and close attention on the architect and throws upon him much work which might be simplified. The contractor and sub-contractor find it a source of bother and delay, while for the superintendent and foreman it means unending watchfulness and repeated shifting of men from one unfinished job to another, because too often materials are not delivered on time, or when they do come they either fail to fit or are not as ordered.

Further labouring of the point is unnecessary. It will at once be recognized by all familiar with construction that anything that can be done to give freater co-ordination of part to part, whether in building design or in the fitting together of materials, will help the industry. Through better understanding between the material supply houses and the construction personnel, architect, contractor, sub-contractor and men on the job many changes in design, delays or mistakes in the delivery of material and equipment can be eliminated, assembly programmes can be better adhered to and the structure closed in sooner, avoiding the handicaps of inclement weather.

Co-ordination. It is suggested that the architect depart from his present day procedure and adopt the practice of selecting stock patterns when available, which patterns have been co-ordinated and approved by certain competent authorities to be described in a later part of this paper.

Because these constructional details are changed to standard they will be kept in stock by the factory or material supply house, and hazards of delay in delivery will be lessened. Similarly when they have become standard patterns the foremen and men on the job having installed such work before, will be familiar with the process of assembly.

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(1) The only accepted departure from this practice is by heating the ingredients forming the concrete, and in brickwork getting the bricks hot from the kiln. The expense involved is usually prohibitive.

The bringing about of more efficient co-ordination of industrial standards and practices has been the subject of close study by experts for many years. One of the fruits of the Versailles Treaty of 1919 was the formation in many countries of research bodies for the purpose of co-ordinating industrial standards of all sorts, and harmonizing, wherever possible, the standards of one country with those of others. The greatest progress has probably been made in the engineering field. The bodies administrating this work are, in Great Britain the "British Standards Institution" in the United States "The American Standards Association" and in Canada the "Canadian Engineering Standards Association". Similar organizations were formed in other countries, but their continued operation has presumably been terminated by the present war. All are financed by membership subscription of manufacturers and industrial groups, professional associations and business bodies.

The American Standards Association, amongst its many subjects of research, made an exhaustive study of building operations and published in August 1941 a brochure covering the development of a system for co-ordination of dimensions of building design, materials and equipment, and the correlation of building plans and details with such dimensions. The procedure advocated and outlined in this brochure is known as the 'Modular System' and the principle upon which it is built is the adoption of dimensions which can be divided into units or modules of four inches. The whole design of any building or article is conceived as being laid out on a grid of four inch dimensional lines, while smaller detail parts are always related to these controlling grid lines.

There are, in the opinion of the writer, many real advantages which may be gained by the use of this system. These will multiply as it becomes more extensively or universally adopted. Some of these advantages are stated below.

Owner or Promoter. (This, it is hoped, would include the Dominion and Provincial governments and all municipalities or governmental bodies who may be interested in new building). The time between first conferences with the architect and the completion of drawings and specifications will be reduced. The reasons for this statement will be seen in the following paragraphs entitled 'architect', 'general contractor' and 'subcontractor'.

Architect. The working drawings can be made more quickly because the dimensioning is much simpler and the likelihood of error reduced. Also the number of architectural details will be lessened, a greater proportion of the materials having been selected from catalogues in which the details and design are shown. These details and design, having been approved by committees of the Standards Association, should normally meet the architect's requirements. He may still, as in the past, design his own finish details, should he desire to do so. He may still also, when he so desires, alter within definitely prescribed limits the stock details approved by the system. But when he makes alterations he must respect the grid or control lines of the detail he is changing, and must recognize that any departure from stock upsets the listed price of the article and the normal time of delivery, because he is changing from standard to special details.

General Contractor. A quantity survey can be more readily made and it will carry greater assurance of reliability than heretofore. There would be fewer delays in delivery because of the smaller amount of work especially fabricated to architects' details. This should tend to a more uniform sequence of task to task and trade to trade.

Subcontractors. Similar advantages would accrue to the sub-contractor. Added to this, a difficulty which often occurs now if a specification is not concise in defining where one trade ends and another begins, would occur less frequently.

Construction Superintendent or General Foreman. The task of setting out the job would be simplified because of the grid lines established by the system and as explained in the brochure. This system, applying to all jobs, would soon be understood by everyone and check and counter check would be easier. Similarly at all stages of progress the grid lines on which the whole Modular System in based would provide readily accessible and undisputed datum points for easy checking of both horizontal and vertical measurements.

Demolition and Excavation. No change.

Concrete. The only change would be that the business of preparing to build having been expedited, concrete workers should be able to start work earlier in the season than they often do now. This business of preparing to build has already been discussed in the earlier pages of this paper and also under 'owner' 'architect' and 'contractor'.

Structural Steel. No change except that this trade would naturally receive its proportion of any increase in building which the Modular System may induce.

Mason and Bricklayer. Same comment as for 'concrete'. The writer is of the opinion that the advantages accrueing to the industry would result in a greater amount of building, including fire-resistant structures. In so far as building work expands, both concrete worker and bricklayer would benefit. The probability of this expansion is however only an opinion, and no proof of its correctness is offered.

It is quite possible that in fire-resistant buildings cinder concrete block may be used more generally without a plastered surface. Co-ordination of block sizes with dimensions of rooms and openings, and the provision of special blocks with electric switch and outlet requirements would eliminate many difficulties of jointing and cutting, and tend toward a presentable and interesting wall treatment.

Carpentry. The carpenter would be affected very largely by extensive adoption of the Modular System, probably more than any other tradesman. For each individual building there would be less carpentry work executed on the site than there is today. However, it is possible that the amount of carpentry work in general, because of the increase in construction as a whole, would be sufficient to outweigh the proportion deducted by pre-fabrication. While the future annual total of carpenter-hours worked on the site would decrease, the total output of the factory and planing mill would necessarily expand, and much wood-working labour would be absorbed there.

Sheet Metal. Without doubt the sheet metal industry will expand. The greatest growth here will probably be in factory and shop. There is little doubt that the warm air heating of the low priced house, a field now ripe for expansion, will progress further into air conditioning. With more uniform standards established for ceiling heights and carpentry framing the duct work for heating will in turn so crystalize that there will be little but assembly done on the site. Probably mechanical ventilation will also become more common in larger buildings including those of the fire-resisting type. Metal roofing and flashing should grow in proportion with building as a whole. It is quite probable, however, that aluminum and new alloys may largely replace the galvanized iron and copper now familiar to the sheet metal worker. These new materials will no doubt call for changes in design and in the tradesmen's technique.

LATHER. The Modular System itself will probably not affect the lathing trade one way or another. In so far as it will increase construction as a shole it should add to this trade, but inasmuch as the use of wall board, has, and will continue to grow, the percentage of lathing should go down. For those buildings in which lathing continues to be used (the more exclusive type of non-fireproof structures) the task of applying the laths can follow more quickly after the beginning of construction under the Modular System since stops and delays should be reduced.

Plastering. As with lathing, the technique and procedure of the plastering trade would probably not be changed in any way by the use of the Modular System. The amount of plastering to be done would increase in direct ratio with the increase in better type building which the system would induce.

It is probable that advances in pre-fabrication will seriously intrude upon the field of the plasterer in the cheaper type of construction (principally small house work) where fibre wall-boards have already made inroads. Gypsum cored wall-boards require less labour per square yard of surface covered than lath-backed plastering,but the increase in building prompted by economies in

construction, and also the new social outlook, will perhaps go far to replace inroads from this quarter.

In the field of fire-resistant building, there are examples where glazed hollow tile in white and light colors has been used for the finished wall surface, thus eliminating the plastering. The extensive adoption of this practice, however, is unlikely because the glazed tile surface gives disappointing acoustic results. Cinder concrete block has a greater sound absorption factor, and advancing technique in its manufacture (see bricklayer) might cut into the work of the plasterer.

Plumbing. One of the great aims of all housing reformers is to raise the number of residential plumbing fixtures per thousand of population. In the expanded housing programme expected after the war there will certainly be a great deal of repeat work, i.e. many houses of one pattern in so far as kitchen and bathroom are concerned. The outcome of this might quite probably be that a few patterns for plumbing-roughing in the floor will be worked out and co-ordinated with known arrangements of framing with which this roughing would be in contact, the pattern of framing also having been uniformly established by the Modular System. Thus, for each of the more common arrangements of fixtures, there would be a complete assembly of floor piping, pro-fabricated in the plumbers shop or supply house and sent to the various jobs, wherever they might be. The economy thus effected would undoubtedly rebound to the advantage both of the general public and the plumbing trade and be reflected in an increase in the number of fixtures installed. This should counterbalance, for the journeyman plumber, any loss he might suffer because of the shorter installation time per fixture.

Steamfitter. The practical extent to which shop assembly of pipefitting can be carried today is very limited, and the Modular System is not likely to alter this. Pipefitting labour should then in the main, continue its present ratio to the annual construction out put. This ratio might, however, be somewhat lessened because of probable improvements and consequent growth of air conditioning and mechanical ventilation.

Electrician. The Modular System as far as can be seen at present, would have practically no effect on the diminution or increase of electrical labour on each job. If this system is instrumental in increasing the total amount of building, the aggregate of electrical work should grow in like proportion. Other factors, such as the spread of electrical power to all country districts, the tightening of electrical codes and an increasing demand for more electrical equipment in each building, will undoubtedly call for more labour in the electric wiring trade.

Painter. The effect of the Modular System on the painting and paper hanging trade would be slight. Painted parts now customarily site built which in future might be pre-fabricated would, before shipping to the job, be primed and perhaps painted one coat. But finish coats would have to be applied at the job in order to match adjoining work. So except for this one rather minor qualification, any increase in construction created by economies in building would mean more work for the painter.

Conclusion. To sum up, it is found that the problem of expanding the work year has two factors, the first being the starting of construction earlier in the season, while the second is the elimination of work stops through improved co-ordination. The solution of the first is publicity and education, since the origin of most building operations arises from public need beyond the personnel of the construction industry. The answer to the second factor, co-ordination, would seem to lie in the discriminating use of pre-fabricated parts. Pre-fabrication is certainly destined to play an important part in future building of all kinds. If it should come unsystematized as come it will, confusion alone will result. The problem then should be of vital interest to the whole industry.

OTTAWA MAY, 1943.

APPENDIX V

GREAT BRITAIN ORGANIZES FOR POST-WAR BUILDING (1)

A comprehensive programme of research and development in the entire building field is already under way as the first part of the programme for post-war rebuilding of British cities and towns. In connection with this programme, Sir Ernest Simon, representative of the Ministry of Works and Planning, is now in the United States rounding up information in regard to research and standardization in the housing field and arranging for the systematic interchange of information on such work between Great Britain and this country. Sir Ernest has made arrangements with the American Standards Association for an informal interchange of data, through which ASA committees in the building field will be kept informed of the results of the British work and will be asked to criticize it.

To carry out the necessary research and development, and to co-ordinate similar work which has been going forward in a large number of professional organizations and trade associations in Great Britain, the Ministry of Works and Planning has set up a series of study committees. Apparently the plan is that these committees will study the entire mosaic of housing to determine where data on good practice is either confused or lacking, and will then carry out research to fill these gaps. The information collected and codified will then be made available to the building industry in Great Britain in a clear and understandable form.

Twenty-two committees have already been recognized by the Ministry. Eleven of these have been organized by Government departments, eight by professional organizations, and three by industrial organizations. Leading representatives of all sections of the industry have joined and are cooperating actively and with enthusiasm in the work of the committees, Sir Ernest reports. The British Standards Institution has a close working relationship with these committees. C. LeMaistre, chairman of the Institution's Executive Committee, is a member of the Main Committee for post-war planning to which the study committees all report; and P. Good, Director of the Institution, is a member of the Standards Committee which is responsible for drafting standards from the reports of the study committees.

So far as possible, the Ministry has left responsibility for the work of the study committees to the organizations which set them up. These organizations consult with the Ministry, appoint members of the committee, and in nearly all cases provide the secretariat.

Committees Work Together

It is expected that a great deal of coordination will be necessary between the committees. The Heating and Ventilating Committee, for instance, will make many recommendations affecting such items as flues, size of windows, insulating power of walls, etc. Thus the recommendations of this committee, and also of the Plumbing Committee and the Lighting Committee, will have an important influence on the work of the Committee on the Design of Houses and Flats.

One of the principal purposes of the Ministry will be to make sure that the committees cover the entire field but that their work does not overlap. In order to accomplish this, the Ministry provides a small central secretariat, including technicians, and has organized three committees to determine policy on questions of design, structure, and installations. The central secretariat is

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(1) Condensed from "Industrial Standardization, and Commercial Standards Monthly", New York, Oct. 1942, Vol. 13, No. 9, pp 243 ff.

consulted by the sponsoring body about the organization of each study committee, the scope of its work, the choice of a chairman, the extent of representation of outside interests, and the form and time of publication of the committee's reports. The Ministry has at least one representative on each study committee, and the chairmen of all the study committees are members of the three policy committees. A main committee under the chairmanship of the Director-General of the Ministry of Works and Planning acts as the final coordinating agency for the entire group of study committees.

It is expected that the work of these committees will move so rapidly that an interim report will be available from each by the end of October. These reports will be circulated as widely as possible for discussion and criticism, and will then be redrafted. It is planned that final reports may be completed by all or most of the committees by May, 1943. When these final reports are completed they will be published under the auspices of the Ministry as a uniform series of volumes, which for the first time, Sir Ernest says, "will provide something approaching a complete scientific basis for the building industry." The work of the study committees "is the first attempt to have the scientific problems of the building industry studied as a whole, avoiding one-sided and partisan presentation. The aim is to secure that the best brains in the industry shall be brought to collaborate closely with all the interests affected in the study of each important aspect of the industry, so that the reports are likely to be accepted as authoritative."

Standards Will Be Drafted

After the reports of the study committees have been completed, a series of standards including specifications, dimensional standards, and methods of test will be drafted. It is expected that every kind of standard applicable to building will be represented, such as minimum standards for consumer requirements and for the performance of materials; standard dimensions and designs intended to increase output, reduce costs, eliminate unnecessary types, and secure interchangeability of units and parts; as well as standard terms and symbols for use in specifications and instructions.

The British Standards Institution is recognized as the organization through which these standards must be welded into a consistent set of national standards which both industry and government can adopt and use. Through the Institution the proposed standards will be circulated to obtain the approval of all concerned. They will then be issued as approved British Standards.

A second series of standards will be Codes of Good Practice. It is planned that these will also be published by the British Standards Institution and it is hoped they will eventually become a national building code. (In Great Britain the legal jurisdiction in such matters is largely centered in the national Government while in the United States it is left primarily in the hands of the city and state governments.)

ASA Closely Tied In

As noted above, Sir Ernest Simon has arranged with the American Standards Association for cooperative exchange of information and material between the British committees and a considerable number of the ASA committees. Sir Ernest has made similar arrangements with the National Housing Agency, the National Bureau of Standards, and the American Institute of Architects for cooperative interchange between these organizations and the British committees.

British Committees Dealing with Building Problems Reporting to the Ministry of Works and Planning.

The British organization to make plans for post-war building heads up in the Directorate of Post-War Building of the Ministry of Works and Planning. A small secretariat has been appointed to take care of the actual work. An Installations Policy Committee, a Structure Policy Committee, and a Design Policy Committee report to this secretariat.

The study committees carrying on research and development in the building field report to the three policy committees as shown in the list below.

The British set-up includes a committee on Codes and Practices whose functions seem to be similar to the ASA Building Code Correlating Committee, which plans, supervises, and correlates the work of the various ASA committees dealing with building code matters. Materials specifications, dimensional specifications, and methods of test, in the British set-up, will be prepared by a Standards Committee. The work of these committees will be cleared through the British Standards Institution.

I. British Committees Reporting to the Design Policy Committee

1. Design of Houses and Flats
2. Design of Houses and Flats for Scotland
3. Committee on House Construction
4. School Planning Group
5. Business Buildings Committee
6. Farm Buildings Committee
7. Committee for the Architectural Use of Materials
8. Acoustics Committee

II. British Committees Reporting to the Structures Policy Committee

1. Steel Structures Committee
2. Reinforced Concrete Structures Committee
3. Timber Structures Committee
4. Walls, Floors and Roofs Committee
5. Committee for Fire-Grading of Buildings.

III. British Committees Reporting to the Installations Policy Committee

1. Lighting Committee
2. Heating and Ventilation Committee
3. Mechanical Installations Committee
4. Electrical Installations Committee
5. Gas Installations Committee
6. Plumbing Committee.

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